JUNE 22, 1981

CARRIAGE OF HANDICAPPED PERSONS

Aerospace Industries Association (AIA) of America, Inc.
Transport Airworthiness Requirements Committee

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Aerospace Industries Association (AIA) of America, Inc.
Transport Airworthiness Requirements Committee

AMERICAN FOUNDATION FOR THE BLIND
15 WEST 16th STREET
NEW YORK, NY 10011

Our gratitude to the many handicapped individuals, representing a wide array of disabilities, who contributed their time, their energies, and their experiences, so that the recommendations contained in this report might more closely represent their needs.

KARL G. HARR, Jr.
President

FOREWORD

It is the intent of those responsible for the preparation of this report to provide the means by which accommodations for the handicapped may be significantly improved aboard passenger aircraft.

The increasing mobility of disabled individuals has created a growing recognition of the problems they encounter in traveling. There is a need for equitable and consistent treatment of the passenger with minimized compromise of accommodations.

THIS REPORT ADDRESSES THE AIRBORNE WHEELCHAIR, PASSENGER SEAT MOVABLE ARM REST, PASSENGER TRANSFER, LAVATORY ACCESSIBILITY, CURTAIN/DOOR VANITY CLOSE-OFFS ADJACENT TO LAVATORIES, IN-LAVATORY ASSIST HANDLES AND OTHER ITEMS OF BENEFIT TO THE WHEELCHAIR-DEPENDENT PASSENGER.

NOTE: THE METHODS AND DESIGNS PRESENTED HEREIN SHOULD NOT BE CONSTRUED AS BEING THE ONLY MEANS OF ACCOMPLISHING THESE IMPROVED ACCOMMODATIONS.

TABLE OF CONTENTS

		PAGE
DEDICATION		i
FOREWORD		ii
TABLE OF CONTENTS		iii
LIST OF FIGURES		viii
PARAGRAPH	TITLE	
1.0	Introduction	1
1.1	Applicability	1
1.2	Limitations	1
2.0	Background	2
3.0	TARC Project Group 218-2	4
3.1	Purpose	4
3.2	Preliminary Study	5
3.3	System Approach	5
4.0	Suggestions	8
4.1	Passenger Seat with Movable Arm Rests	9
4.2	Lavatory Access Provisions	9
4.3	Lavatory Interior Provisions	10
4.4	Curtain/Door Close-offs in Vicinity of the Lavatory	11
4.5	Aid Kit for the Disabled Traveler	12
4.6	The Airborne Wheelchair	13
4.7	Stowage of Equipment Aboard the Airplane	14
5.0	Summary	15

APPENDIX

PARAGRAPH	TITLE	PAGE
A.	A Study of Disabilities within the United States	16
A. 1	General	16
A. 2	Statistics of Disabled Persons	17
B.	Passenger Seats with Movable Arm Rests	24
B. 1	General	24
B. 2	UOP Seat	24
B. 3	Weber Seat	24
B. 4	Fairchild Burns Seat	25
C.	Lavatory Access Provisions	30
C. 1	General	30
C. 2	Threshold Ramp	30
C. 3	Threshold Joint-Strip	31
C. 4	Doorway Size	31
D.	Lavatory Interior Provisions	36
D. 1	General	36
D. 2	Support/Grab Bar Provisions	36
D. 3	Chair to Toilet Transfer Provisions	37

PARAGRAPH	TITLE	PAGE
E.	Curtain/Door Close-offs in the Vicinity of the Lavatory	39
E. 1	General	39
E. 2	Curtain Concept and Proposed Operation	39
E. 3	Door or Panel Concept	39
F.	Aid Kit for the Disabled	43
F. 1	General	43
F. 2	Lavatory Aids	43
F. 3	Dining Aids	44
F. 4	Miscellaneous	44
G.	Airborne Wheelchairs	48
G. 1	General	48
G. 2	Carrier Aircraft Airborne Wheelchair	48
G. 2. 1	General	48
G. 2. 2	Description and Operating Envelope	48
G. 2. 3	Proposed Operation	50
G. 2. 4	Capabilities/Limitations	52
G. 3	Fulton Airport Chair	53
G. 3. 1	General	53
G. 3. 2	Description and Operating Envelope	53
G. 3. 3	Proposed Operation	54
G. 3. 4	Capabilities/Limitations	55

PARAGRAPH	TITLE	PAGE
G.	Airborne Wheelchairs (Cont'd)	
G. 4	University of Virginia Wheelchair System	56
G. 4. 1	General	56
G. 4. 2	Description and Operating Envelope	56
G. 4. 3	Proposed Operation	57
G. 4. 4	Capabilities/Limitations	58
G. 5	Everest and Jennings Aircraft Passenger Loading Chair (E & J Canadian Ltd.)	59
G. 5. 1	General	59
G. 5. 2	Description and Operating Envelope	59
G. 5. 3	Proposed Operation	59
G. 5. 4	Capabilities/Limitations	60
H.	Stowage of Airborne Equipment	66
H. 1	General	66
H. 2	Kit for the Disabled Traveler	66
H. 3	Airborne Wheelchair	66
H. 4	Adaptive Equipment for Lavatory/Wheelchair Interface	67
J.	Summary of Testing for Access of Disabled Persons to Wide-Body Airplanes	68
J. 1	General	68
J. 2	Equipment Testing Conducted at Daniel Freeman Hospital Medical Center	68
J. 3	Testing Conducted on Airplanes at Airport	74
J. 4	Testing Conducted Aboard Pan American Flights	75

PARAGRAPH	TITLE	PAGE
K	Supplier Information	84

LIST OF FIGURES

FIGURE	TITLE	PAGE
A-1	Functional Disability	18
A-2	Estimated Annual Average Number of Injuries in the United States, 1973-1975	18
A-3	Disabling Injuries by Severity of Injury, 1976	19
A-4	Disabling Sensory Disorders	19
A-5	Disabling Neurological Disorders	20
A-6	Handicapped - Urban and Rural Elderly	21
A-7	Statistics - Functional Disabilities Affecting Hand Use	22
B-1	Seat/Aisle Dimensions	26
B-2	UOP Inc. Passenger Seat with Movable Aisle Arm Rest	27
B-3	Weber Aircraft Passenger Seat with Movable Arm Rest	28
B-4	Airest 2000 Handicapped Endbay	29
C-1	Lavatory Threshold Ramp	32
C-2	Lavatory Threshold Panel Ramp	33
C-3	Lavatory Threshold Joint Strip	34
C-4	Lavatory Door Size	35
D-1	Lavatory Interior Modification	38
E-1	Single Lavatory Privacy Curtained in Double Complex	40
E-2	Outboard Lavatory Curtain Close-off	41
E-3	Lavatory Opposing Doors Serve as Privacy Screen	42

LIST OF FIGURES

FIGURE	TITLE	PAGE
F-1	Aid Kit for the Disabled	45
F-2	Aid Kit - Lavatory Equipment	46
F-3	Aid Kit - Dining Equipment	47
G-1	Airborne Wheelchair Comparisons	61
G-2	Carrier Aircraft Airborne Wheelchair	62
G-3	Fulton Airport Chair	63
G-4	University of Virginia Wheelchair System	64
G-5	Everest & Jennings Aircraft Passenger Loading Chair	65
J-1	Aircraft Functional Analysis for the Disabled Traveler	76
J-2	Airborne Wheelchair Checkout	77
J-3	Transfer Checkout	78
J-4	Lavatory Checkout	79
J-5	General Information and Comments	80
J-6	Summary - Aircraft Functional Analysis for the Handicapped Traveler	81
J-7	Physical Condition of Individuals entered in Summary	82
J-8	Testee's Comments	83

1.0 INTRODUCTION

The purpose of this report is to document TARC Project Group suggested accommodations within wide-body aircraft, existing and under development, to facilitate the carriage of disabled persons requiring a wheelchair for movement within these airplanes.

An appendix of references is provided which details the background considerations, studies, data compiled, equipment and facilities evaluated, test results, and inputs from various sources.

1.1 APPLICABILITY

The studies contained herein apply to all certified wide-body aircraft. Much of the material described herein is also useable on narrow-body aircraft without aircraft modification.

1.2 LIMITATIONS

The studies contained herein:

(1) Apply to all wide-body aircraft.

(2) Apply to accommodation of wheelchair-dependent persons.

(3) Indirectly apply to travelers with other disabilities.

The number of passengers with mobility disabilities for which provisions should be made on each airplane and the location(s) for their seating has not been addressed. These questions are best answered by each specific airline.

2.0 BACKGROUND

The Federal Aviation Administration (FAA) in 1978 requested that the Aerospace Industries Association of America (AIA) investigate the feasibility of developing for new aircraft and for possible retrofit, movable arm rests at the aisles to facilitate passenger transfer from a wheelchair to a seat. The Transport Airworthiness Requirements Committee of AIA established TARC Project Group 218-2 shortly thereafter to investigate the FAA request and to make recommendations to the TARC committee. Representatives of the three major aircraft companies, Boeing, Lockheed and McDonnell Douglas are members of the project group. Airbus Industries, although not a member of TARC 218-2, is participating in the program to ensure that a worldwide standard is considered.

In 1979 the TARC Project Group 218-2 expanded the scope of the program to include all aspects of carriage of handicapped persons. Responding to the expressed needs of airframe manufacturers, the airlines, and the disabled community, the committee felt that the most satisfactory resultant would be a "list of suggestions" for use by those concerned.

This initial effort has been concentrated on the airborne wheelchair, passenger seat movable arm rest, passenger transfer, lavatory accessibility, curtain/door vanity close-offs adjacent to lavatories, in-lavatory assist handles and other items of benefit to the wheelchair-dependent passenger.

Through Rehabilitation International U. S. A. (RIUSA), a Technical Advisory Committee (TAC) was formed in May 1979 to support TARC 218-2 by providing people and organizations, knowledgeable in the needs of the disabled, and facilities for test and evaluation of equipment. Daniel Freeman Hospital Medical Center, Inglewood, California, and the University of Virginia Rehabilitation Engineering, Charlottesville, Virginia, joined TAC to support development and tests of various hardware under consideration. Airbus Industries and Rehabilitation International, through its International Commission on Technical Aids, Housing & Transportation also participated in the development and test program. Pan American World Airways aided testing by providing airplanes and personnel for flight evaluation of an airborne wheelchair, aid kit, and other equipment.

3.0 TARC PROJECT GROUP 218-2

3.1 PURPOSE

The purpose of TARC Project 218-2 is to investigate methods to facilitate the carriage of the disabled within commercial transport airplanes.

This report approaches the needs of wheelchair-bound disabled passengers aboard the wide-body category aircraft; i. e., Boeing 747, Douglas DC-10, Lockheed L-1011, Airbus Industrie A300, Boeing 767 and Airbus Industries A310. A segment of the disabled populace requires a wheeled chair for mobility and this item provides the single most important impediment to facilitating their air travel. The commitee's scope has been limited to accommodations considerations aboard the aircraft, as it is felt that terminal and ground handling problems fall most logically in the domain of airline and port authority operations and are not in the purview of airframe manufacturers.

Much of what has been determined during the committee's investigation and study is applicable to aircraft in other categories; i. e., the standard-body airplanes such as Boeing 707, 727, 737 and Douglas DC-8 and DC-9, and new models of similar cross section.

Although this report only partially answers the handicapped traveler accommodations problems, the committee believes that the most significant questions are considered. The suggestions provided herein should therefore be of value for further action by airline and airframe manufacturers.

3.2 PRELIMINARY STUDY

Once the organizational apparatus had been defined, it was possible for TARC 218-2, working in conjunction with the Technical Advisory Committee, to select those areas of the wide-body passenger cabin thought to represent major obstacles to disabled persons. All effort was applied to develop guidelines for equipment and airplane provisions to alleviate the obstacles in the defined areas. A criterion of each proposed provision was that, as much as possible, it serve all disabled travelers. Mobility within the passenger cabin is desirable for successful accommodation of the disabled. Early in the program it was determined that adapting equipment to current airplane cabin configurations rather than airplane redesign would be a viable and effective approach. Hence, the decision to suggest airborne equipment specifically adapted for aircraft use.

An additional consideration was the attempt to accommodate disabled persons while providing cabin service comparable to that available to other travelers. This consideration necessitated the study of the physical, neurological and sensory capabilities and limitations of disabled persons to determine the subject group's profile. It appears that with proper consideration and design implementation it will be possible to service the needs of the majority of the disable population.

3.3 SYSTEM APPROACH

The approach taken to the problem of handicapped passenger carriage aboard airplanes was to view it in a systems manner. The interaction of many elements demanded a study of the total system. After this was done, individual areas of consideration and specific solutions to particular problems were possible. The primary elements are: the disabled person, crew members, other able bodied persons (passengers), and provisions, equipment and fixtures within the aircraft interior. The interactions of these elements specific to the problem at hand include: disabled person mobility, access of disabled persons to passenger cabin furnishings and compartments,

and use of provisions by the handicapped passengers and any assistance required for them. The normal flying experiences encountered by able bodied persons must be evaluated in terms of the disabled traveler's limitations and capabilities; namely boarding, seating, garment removal and stowage, on-board baggage stowage, lavatory usage, eating and beverage consumption, reading and entertainment enjoyment, and all of the other amenities and features afforded the airline passenger.

Surveying this mass of element and activity interaction, the project members have separated out certain areas of consideration where hardware development, design of accommodations, and the provisioning of assistive devices may enhance the carriage of handicapped persons.

Those areas identified are:

1. Movement within the airplane
2. Access to passenger seats
3. Access to the lavatories
4. Access to facilities within the lavatory
5. Use of airline services and airplane equipment (i. e., food services, entertainment equipment, etc.)

Each of these five areas containing major obstacles has been studied for passengers suffering from mobility handicaps and needs of access, with mobility and accommodation considered, including wheelchair interface. The study reduced the list of development candidates to seven items:

1. Passenger seat with movable arm rest
2. Lavatory access provisions
3. Lavatory interior provisions
4. Curtain/door close-offs in the vicinity of the lavatory
5. Aid kit for the disabled
6. The airborne wheelchair
7. Stowage of equipment aboard the aircraft

Accessibility to and use of cabin facilities normally available to airline passengers creates a requirement for mobility for the wheelchair-dependent passenger. This requirement influenced the selection of an airborne wheelchair as the single most important component for improving service for disabled passengers. Anticipated airplane provisions are reduced by use of such a wheelchair to those of providing assist rails, curtain close-offs, threshold ramps, etc. The need for major structural modifications involving lavatory area expansion and increased aisle widths can thus be eliminated.

In order to verify the conclusions reached after consultation and analysis, a test and evaluation program was initiated involving mockups of wide-body lavatories and prototype equipment. This activity included use of prototype equipment aboard aircraft on the ground and in flight. Actual disabled subjects with a range of disabilities were utilized and an evaluation was conducted by professional clinicians in the rehabilitation counseling field. Portions of the findings were video recorded and all testing was well documented.

In November of 1979, TARC 218-2 invited interested airlines and the Air Transport Association to Daniel Freeman Hospital Medical Center to review the TARC program status. Mockups of wide-body aircraft lavatories, i. e., Boeing 747, B767, Lockheed L-1011, McDonnell Douglas DC-10 and Airbus Industries A300 and seats from Fairchild-Burns Company, U. O. P. and Weber Aircraft were on display for review by the conference participants in conjunction with equipment demonstrated. The test program was also discussed and test data presented.

4.0 SUGGESTIONS

Each of the seven suggested areas for development are discussed in the following sections. The first four interface with an airborne wheelchair; consequently, the suggested provisions will vary with the versatility and capability of the wheelchair design selected by the airline.

The identified equipment needs described separately in this section should be thought of as a system that functions coherently throughout the passenger cabin. Considering the equipment in isolation reduces its effectiveness.

The system services the needs of the disabled passenger in boarding the aircraft, in transit to and from the passenger seat and in gaining access into the lavatory. It excludes equipment and procedural processes external to the aircraft.

4.1 PASSENGER SEAT WITH MOVABLE ARM REST

Functional problem:
Present passenger seat arm rest on the aisle side impedes transfer to and from the aisle chair.

Disabled Person Needs:
While the arm rest is valuable for many disabled after being seated for leverage and comfort, it is an obstruction which is difficult to maneuver over.

Proposal to Meet Needs:
An articulating arm rest which moves out of the transfer path should be incorporated into selected passenger seats. Its deployment must comply with FAA aisle dimensional clearances shown in Figure B-1. Deployment should be easy to accomplish without a tool and be secure in normal arm rest position. Several designs have been submitted for evaluation. These concepts are described in Appendix B.

4.2 LAVATORY ACCESS PROVISIONS

Functional problem:
Lavatories are placed in a variety of locations throughout the configurations of the different airlines and airframes. Equal ease of access via an airborne chair does not exist in many configurations. Contributing to the awkwardness are restrictive crossaisle widths, walls adjacent to lavatory openings, placement of attendant seats, narrow intersections which limit turning of a wheeled chair, and other features peculiar to an airline's configuration.

Disabled Person Needs:
Long trips to the lavatory via an airborne chair would be undesirable as would difficult maneuvers around the restrictive elements mentioned

4.2 LAVATORY ACCESS PROVISIONS (Continued)

above. The most inconspicuous trip to the lavatory would be desirable. At the lavatory, clearances for the chair must be maintained and provisions made for passenger transfer into the lavatory and onto the toilet.

Proposal to Meet Needs:
Selection of the most appropriate lavatories for handicapped passenger accommodation within the individual configuration should be made. Placement of the disabled person in close proximity to the lavatories should be made with due consideration being given to crew convenience and emergency evacuation. Provisions within the lavatories for use by disabled persons will depend a great deal upon the airborne wheelchair selected for airline use. Several prototype chairs have been evaluated for lavatory interface. The dimensions of these are detailed in Appendix G. One model (Carrier Aircraft Airborne Wheelchair) was designed for entry into the lavatories of the wide-body airplanes and provides for translation of the user over the toilet without leaving the wheelchair.

If a translating-chair is not used, suitable hand supports and toilet-to-chair transfer surfaces should be provided.

4.3 LAVATORY INTERIOR PROVISIONS

Functional Problems:
For those persons using the toilet, but not capable of standing, the amenities supply locations and the functional hardware (i. e., washbasin, water spigots, toilet flush control, etc.) may be beyond their reach or may be difficult to use.

Disabled Person Needs:
The hardware of the lavatory(ies) for use by disabled persons should be designed with location and operation by them in mind or other provisions made.

4.3 LAVATORY INTERIOR PROVISIONS (Continued)

Proposal to meet Needs:
The confined space within an aircraft lavatory aids the disabled in functioning within the compartment. For those with full arm function, reaching hardware within the lavatory is attainable. No suggestions are made to relocate existing hardware within the lavatory, since there is no one specific location that can satisfy all categories of disability.

The one item of hardware suggested for the lavatory(ies) for use by disabled persons is the addition of an assist rail. Normal function of the lavatory will be retained for other passengers.

4.4 CURTAIN/DOOR CLOSE-OFFS IN THE VICINITY OF THE LAVATORY

Functional Problem:
Due to the space required by an airborne chair and the lack thereof in the lavatory compartment it may be necessary for the disabled person to either prepare themselves for use of the toilet outside of the compartment or to have the compartment door open during transfer from the chair to toilet, and possibly during use of the toilet. Consequently an increased area of privacy is desirable for this activity to occur with minimum disturbance to other passengers.

Disabled Person Needs:
The user must be maneuvered via an airborne chair into sufficient proximity of the toilet seat to enable transfer. They must also have sufficient space and privacy for clothing removal. In some instances their own personal assistant will need room to aid them in these movements. The privacy means must be sufficient to ensure that inadvertent disturbance by other passengers does not result in an embarrassing situation.

Proposal to meet Needs:
The privacy area (or vanity area) desirable is dependent upon the design of the airborne chair used. One prototype chair evaluated, having a translating seat, would allow most disabled persons to

4.4 CURTAIN/DOOR CLOSE-OFFS IN THE VICINITY OF THE LAVATORY (Cont'd)

close the lavatory door after the wheelchair seat translation has taken place. However, for the quadraplegic, space for this attendant is required. Also, persons capable of transfer from the chair to the toilet may choose not to use the translating seat feature and would need the staging area for some unclothing and maneuvering.
A curtain(s) or doors should be configured to create a staging area adjacent to the lavatory door opening. Studies of typical deck plans for the airplanes under consideration demonstrate that this is usually feasible for one or more lavatories. Some concepts are described and illustrated in Appendix E.

4.5 AID KIT FOR THE DISABLED TRAVELER

Functional Problems:
There are within the airplane cabin environment equipment peculiar to air travel (e.g., attendant call button) that many disabled persons cannot reach or manipulate even with experience. Also, the close proximity of other passengers can make dining difficult for those with impaired limb control or hand grip.

Disabled Person Needs:
The disabled person requires means by which he can operate equipment unique to the airplane cabin and can more comfortably dine in the close quarters afforded by the passenger seating.

Proposal to Meet Needs:
A kit containing adaptive devices for airplane hardware may be helpful. Consideration should be given to making these kits a saleable commodity, to be owned by the user. This would significantly reduce storage and theft problems which might otherwise plague the airlines. The kit could contain two distinct categories of items; one for lavatory use and the other for dining, plus miscellaneous items.
The Lavatory aids:

- A reaching device
- Emergency call adapter
- Lighting adapter
- Faucet adapter

4.5 AID KIT FOR THE DISABLED TRAVELER (Continued)

The Dining Aids:

- o Tray and plate guards
- o Adaptive devices for eating utensils and cup
- o Placemat for securing food tray to support surface

Miscellaneous:

- o Information Booklet.

The suggested kit contents are described in Appendix F

4.6 THE AIRBORNE WHEELCHAIR

Functional Problem:

The disabled person arrives at the cabin entry either in their own wheelchair or in one provided by the airline or port authority. In most circumstances this vehicle is not small or maneuverable enough to deliver the individual to the appropriate passenger seat. Transfer at the cabin entry door to a smaller wheeled chair is necessary. The disabled person cannot normally utilize lavatory facilities without being transported to them via an aisle chair.

Disabled Person Needs:

Transfers should be accomplished so as to minimize discomfort, embarrassment, exposure to injury and physical effort on the part of the disabled person, and assisting airline personnel. Although many disabled passengers exercise personal control measures to avoid the necessity of using the lavatory, it may be expected that such need may be necessary particularly during a longer flight profile.

Proposal to Meet Needs:

A versatile airborne chair is suggested.

The maximum wheelchair width is dictated by the minimum permissible aisle width specified by FAR Part 25, Para. 25.815; a dimension of fifteen (15) inches, that must be maintained from floor level up to 25 inches above the floor and 20 inches width above that. The maximum

4.6 THE AIRBORNE WHEELCHAIR (Continued)

recommended wheelchair width is 14.50 inches, up to a height of 25 inches, allowing one-quarter inch clearance per side. The wheelchair seat height should be compatible with passenger seat and toilet seat heights and accommodate any necessary mechanism for passenger transfer to these seats. The wheelchair seat back and any foldable arm rests should be contained within a dimension of seventeen (17) inches, to allow entry into a minimum lavatory door opening of approximately seventeen and three quarter (17-3/4) inches.

Several prototype airborne wheelchairs have been developed which are candidates to satisfy some or all of these requirements. They have been tested and evaluated during the committee's investigation. A matrix of their features and limitations is provided for guidance in Appendix G. Additional designs are available or under development.

4.7 STOWAGE OF AIRBORNE EQUIPMENT

Functional Problems:

Providing service for the disabled aboard aircraft requires that equipment be available not only for boarding and deplaning, but during the flight. Equipment must be stowed when not in use, readily accessible and conveniently available when requested.

Needs of the Disabled Person:

Equipment used by the disabled should be maintained and available in the same relationship as other amenities that are provided by the carrier.

Proposal to Meet Needs:

Stowage space aboard airplanes is always a problem. Also, cabin interior arrangements and aircraft types vary. Therefore, stowage locations within the cabin must be at the discretion of the aircraft operator. Suggested locations: stowage cabinets, cabin divider, partitions, coat closets and overhead center/sidewall stowage modules. The equipment that will require stowage aboard the aircraft:

1. Airborne wheelchair
2. Aid kit for the disabled
3. Adaptive equipment for lavatory/wheelchair interface, such as a threshold ramp

NOTE: Structural adequacy of stowage provisions requires FAA approval.

5.0 SUMMARY

In summary TARC Project Group 218-2, Carriage of Handicapped Persons, has completed its study. With the help of TAC and many other interested and knowledgeable people and organizations, a list of suggestions has been developed. These suggestions represent state-of-the-art design which will accommodate certain segments of the handicapped populace aboard wide-body airplanes.

APPENDIX A

A. A STUDY OF DISABILITIES WITHIN THE UNITED STATES

A.1 General

The TARC Project Group 218-2 requested Rehabilitation International U. S. A. (RIUSA) to act as a single point of contact for activities concerning organizations for the handicapped. RIUSA was also asked to utilize resources known and available to them to establish major classifications of handicapped, including descriptions of their abilities. This approach reduced the time required by the TARC Project for self education, compilation and categorization of data.

RIUSA through its Technical Advisor Committee (TAC), agreed to support TARC 218-2. Jeffrey Klein of Daniel Freeman Hospital Medical Center (DFHMC) is a member of TAC. He and his staff compiled the data presented in this Appendix.

Anthropometric data specifically developed for use in aircraft interior design is limited.

In March of 1980, the Technical Advisor Committee was moved from RIUSA to RI with the thought of improving this data gathering process. The committee membership was expanded to include the addition of European members. In addition, the testing and evaluation protocol established by DFHMC was modified to include wheelchair evaluation within the airport jetway. These changes

were initiated in order to standardize on test and evaluation procedures (new and existing) used by other rehabilitation facilities and to increase the collection of anthropometric data. TARC 218-2's use of this data will be limited to aircraft interiors whereas organizations involved with access to aircraft studies will use the jetway information.

A.2 Statistics of Disabled Persons

The information presented in Tables A-1 through A-5 was obtained from the following sources:

HEW National Center for Health Statistics
1960 & 1970 Census of Population

HEW National Institute of Neurological &
Communicative Disorders & Strokes, 1976

HEW Interior Report on National
Advisory Eye Council, 1976

The statistics provided in Tables A-6 and A-7 were assembled from records compiled by DFHMC and from the sources listed above.

APPENDIX A

TABLE A-1

FUNCTIONAL DISABILITY	EST. NUMBER
Non-Institutional: Chronic Conditions	
1. Uses wheelchair	430,000
2. Uses walker	410,000
3. Uses other special aids	5,470,000
4. Other mobility limitations	3,310,000
5. Deaf	1,800,000
6. Hearing impaired	11,600,000
7. Visually impaired	2,200,000
	25,220,000

TABLE A-2

ESTIMATED ANNUAL AVERAGE NUMBER OF INJURIES IN THE U. S., 1973 - 1975

CLASS OF ACCIDENT	BED DISABLING INJURIES	NOT BED DISABLING: WITH ACTIVITY RESTRICTION	NOT BED DISABLING: WITHOUT ACTIVITY RESTRICTION (MEDICALLY ATTENDED)	TOTAL PERSONS INJURED
ALL CLASSES	16,685,000	22,365,000	24,622,000	63,672,000

APPENDIX A

TABLE A-3

DISABLING INJURIES BY SEVERITY OF INJURY, 1976

SEVERITY OF DISABLING INJURY	TOTAL
All Disabling Injuries[1]	10,300,000
Permanent Impairments[2]	370,000
Temporary Total Disabilities	9,900,000

1. Disabling beyond the day of accident. Injuries are not reported on a national basis, so the totals shown are approximations based on ratios of disabling injuries to deaths developed from special studies.
2. The term "permanent impairments" includes both permanent partial and permanent total disability.

TABLE A-4

DISABLING SENSORY DISORDERS

	ESTIMATED NUMBER OF CASES	FUNCTIONAL DISABILITIES
DEAF (NO AUDITORY INPUT)	1,800,000	
HEARING IMPAIRED (REDUCED AUDITORY INPUT)	11,000,000	Sufficient to alter normal pattern of living
SPEECH IMPAIRED	10,000,000	Comprehension by others

APPENDIX A

TABLE A-5

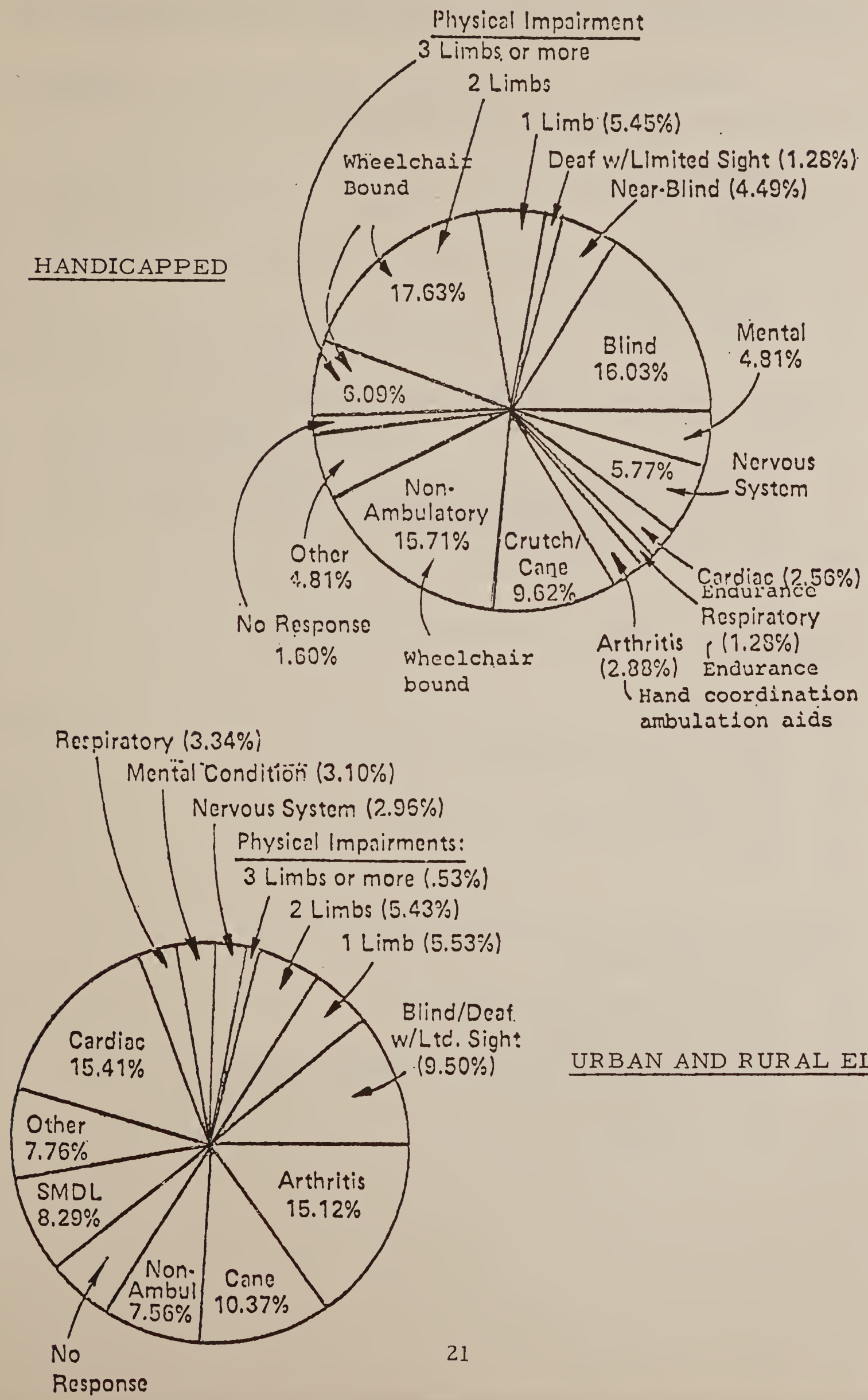
DISABLING NEUROLOGICAL DISORDERS

	ESTIMATED NUMBER CASES	FUNCTIONAL DISABILITIES
AMYOTROPHIC LATERAL SCLEROSIS (ALS)	10,000	Muscle weakness, wheelchair, respiratory problems
CEREBRAL PALSY	750,000	Hand coordination, perceptual speech problems, wheelchair
FRIEDREICH'S ATAXIA	5,000	Balance - may require wheelchair
HEAD INJURY	3,000,000	Visual and language problems, ataxia, paralysis (may require wheelchair)
MULTIPLE SCLEROSIS	250,000	Coordination, speech, vision balance, wheelchair
MUSCULAR DYSTROPHY	200,000	Weakness, endurance, wheelchair
ALL NEUROMUSCULAR DISORDERS	1,000,000	Weakness, coordination, endurance speech, vision, balance
PARKINSON'S DISEASE	500,000	Endurance, coordination, speaking
SPINA BIFIDA	12,000/yr	Wheelchair, ambulation aid requirement
SPINAL CORD INJURY	200,000	Wheelchair, balance, hand function (50 percent bowel and bladder)
STROKE (CVA)	2,500,000	Hemiplegia, wheelchair, judgement language
TUMORS OF THE BRAIN AND OTHER PARTS OF THE NERVOUS SYSTEM	32,000	Wheelchair, balance, hand function (50 percent bowel and bladder) hemiplegia, judgement, language

APPENDIX A
TABLE A-6

HANDICAPPED - URBAN AND RURAL ELDERLY

HANDICAPPED



URBAN AND RURAL ELDERLY

APPENDIX A

TABLE A-7

STATISTICS-FUNCTIONAL DISABILITIES AFFECTING HAND USE

Conditions	Number Affected
1) Conditions requiring the use of one hand	
a. Amputation of one arm	
b. Cerebrovascular Accident - Stroke	2,500,000
c. Polio	
d. Fractures of shoulder, arm, writ or hand (temporary)	
e. Multiple Sclerosis	250,000
f. Hand Trauma	
g. Arthritis (less likely)	20.2 million
Probable solutions to problems associated with using one hand	
a. Non slip surface	
b. Stabilization of objects	
c. Rocking motion instead of slicing	
d. Easy opening containers	
e. One action at a time	
2) Conditions resulting in hand and arm weakness (weak grip)	
a. Arthritis	20.5 million
b. Cerebrovascular Accident - Stroke	2,500,000
c. Gullian Barre Syndrome	
d. Quadriplegia	100,000
e. Amyotrophic Lateral Sclerosis	10,000
f. Muscular Dystrophy	200,000
g. Aging	
Probable solutions to problems associated with arm and hand weakness	
a. Enlarged handles and grips	
b. Lightweight objects	
c. Easy opening containers	
d. Handles mounted on objects requiring lifting	
e. Large knobs, buttons	
f. Push - not twist	
g. Low resistance	

TABLE A-7 (Continued)

Conditions	Number Affected
3) Conditions resulting in motor incoordination tremors, instability in arms and hands	
a. Cerebral Palsy	750,000
b. Multiple Sclerosis	250,000
c. Parkinsonism	500,000
d. Head Injury	3,000,000
e. Aging	
Probable solutions to problems associated with incoordination, etc.	
a. Non slip surface	
b. Handles and grips on objects	
c. Stabilization of objects	
d. Large knobs, buttons	
e. Rims of elevated borders around work surfaces	

APPENDIX B

B. PASSENGER SEATS WITH MOVABLE ARM RESTS

B. 1 General

The articulating arm rest provides a transfer path to/from the passenger seat by folding out of the way of the passenger to allow the transfer procedure to take place.

B. 2 Universal Oil Products (UOP) - Figure B-2

The arm rest in this seat is hinged at the seat back to rotate upward ninety degrees (90^{o}) approximately into the seat back plane. This is accomplished by first unlatching a spring load pin, located near the hinge point, and applying a force to the underside of the arm rest. Once the applied force is released, the arm returns to a horizontal position.

B. 3 Weber Aircraft - Figure B-3

The arm rest in this seat is hinged at the aft end to rotate upward approximately 90^{o}. The arm rest is supported forward by a vertical column which is attached to the arm rest. The lower end of this support snap locks into the aisle frame structure. It can be released by actuating a spring loaded pin.

B.4 Fairchild Burns Seat - Figure B-4

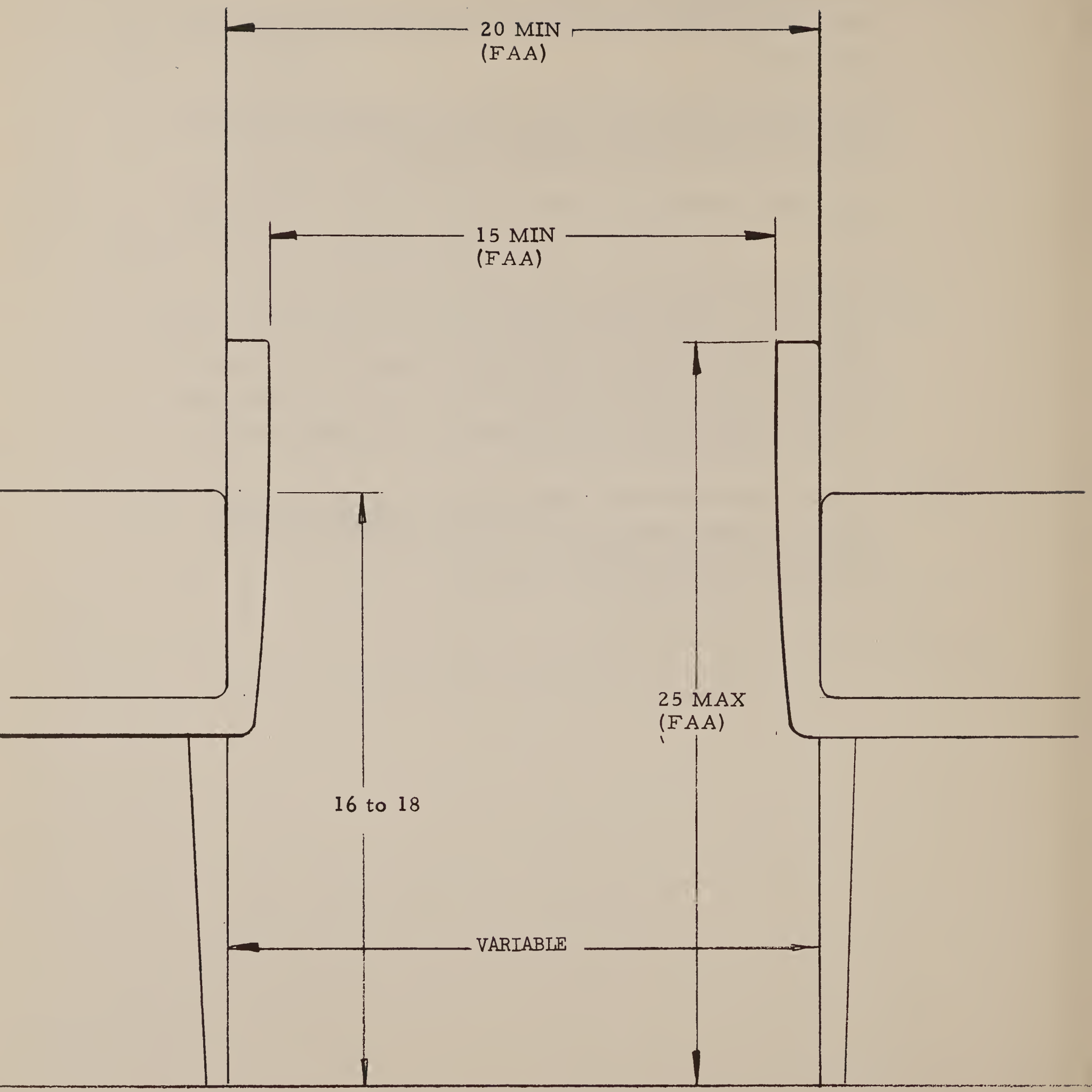
The seat depicted in Figure B-4 is Fairchild Burn Company's Airest 2000.

The Airest 2000 modular design allows removal of a standard endbay assembly by disengaging three bolts.

The folding handicapped endbay attaches to these same three bolts.

This endbay is designed to parallelogram down so that the top of the arm rest is flush with or slightly below the top surface of the bottom cushion. A release pin is located on the inner aft portion of the arm rest and must be released to disengage or to re-engage the arm rest from or to its upright position.

NOTE: These designs reflect the configurations presented during a specific calendar period and it is expected that further improvements may already be available.

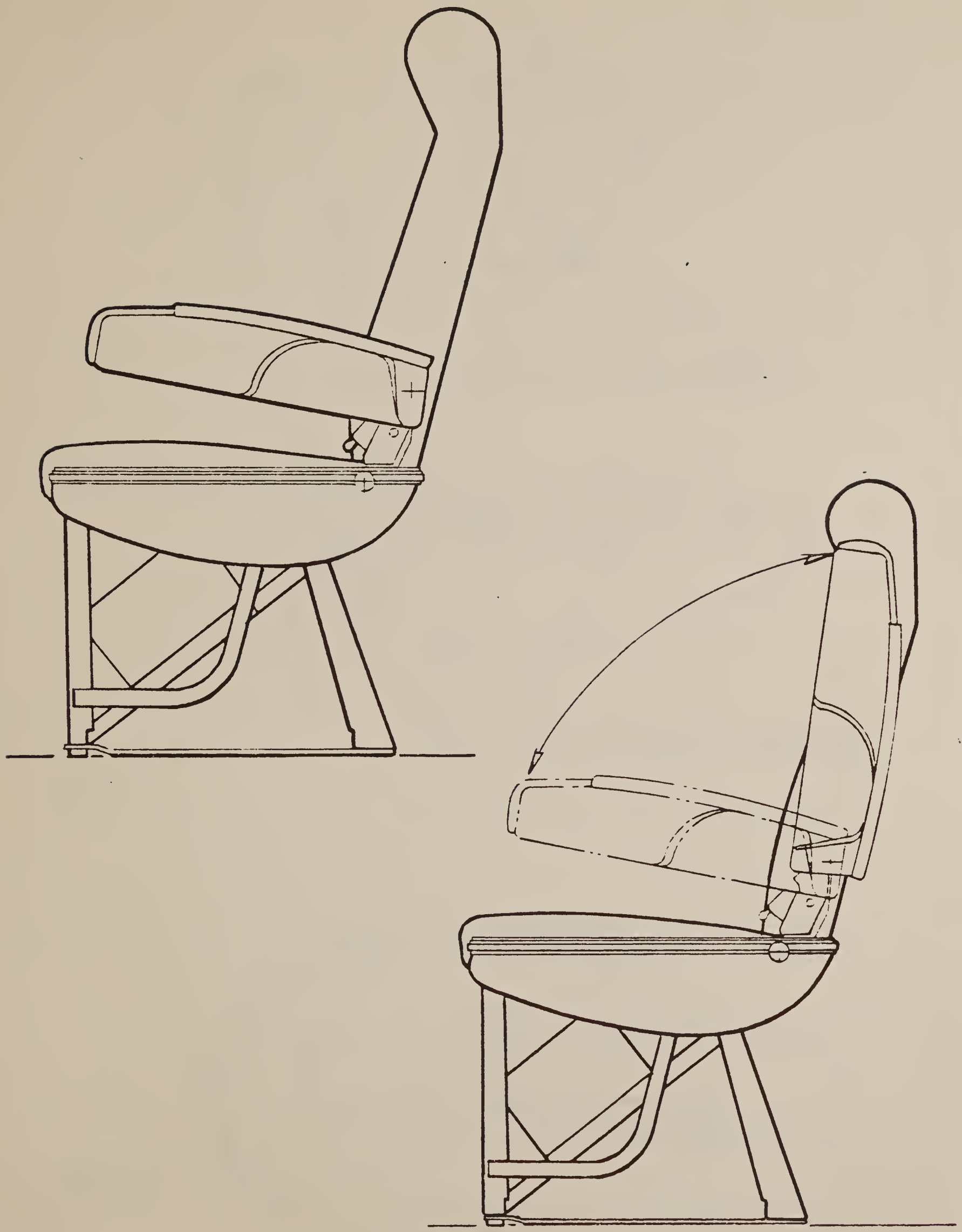


DIMENSIONS IN INCHES

FIGURE B-1

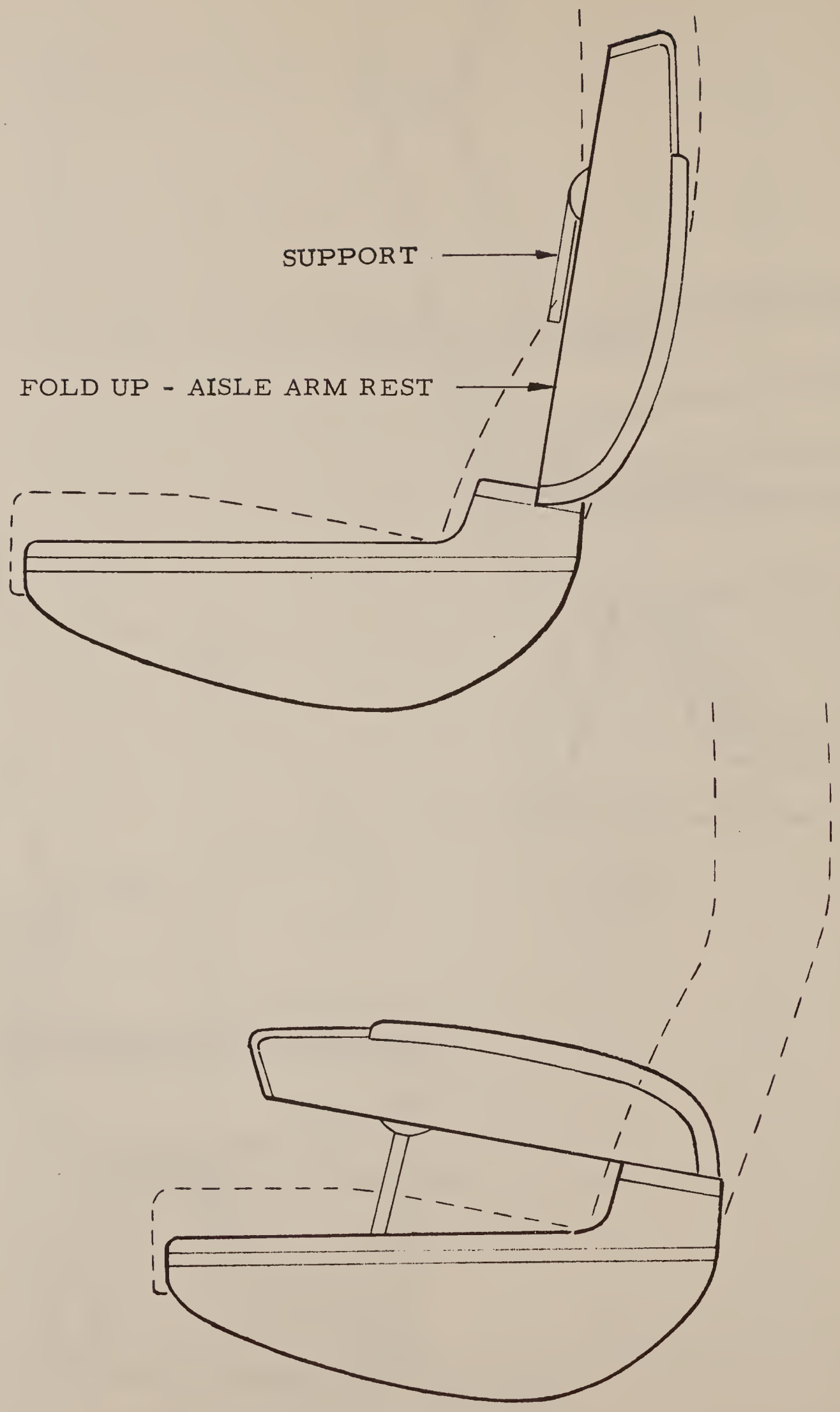
DIMENSIONS SHOWN ARE IN ACCORDANCE WITH FAR PART 25 PARA. 25.815

SEAT/AISLE DIMENSIONS



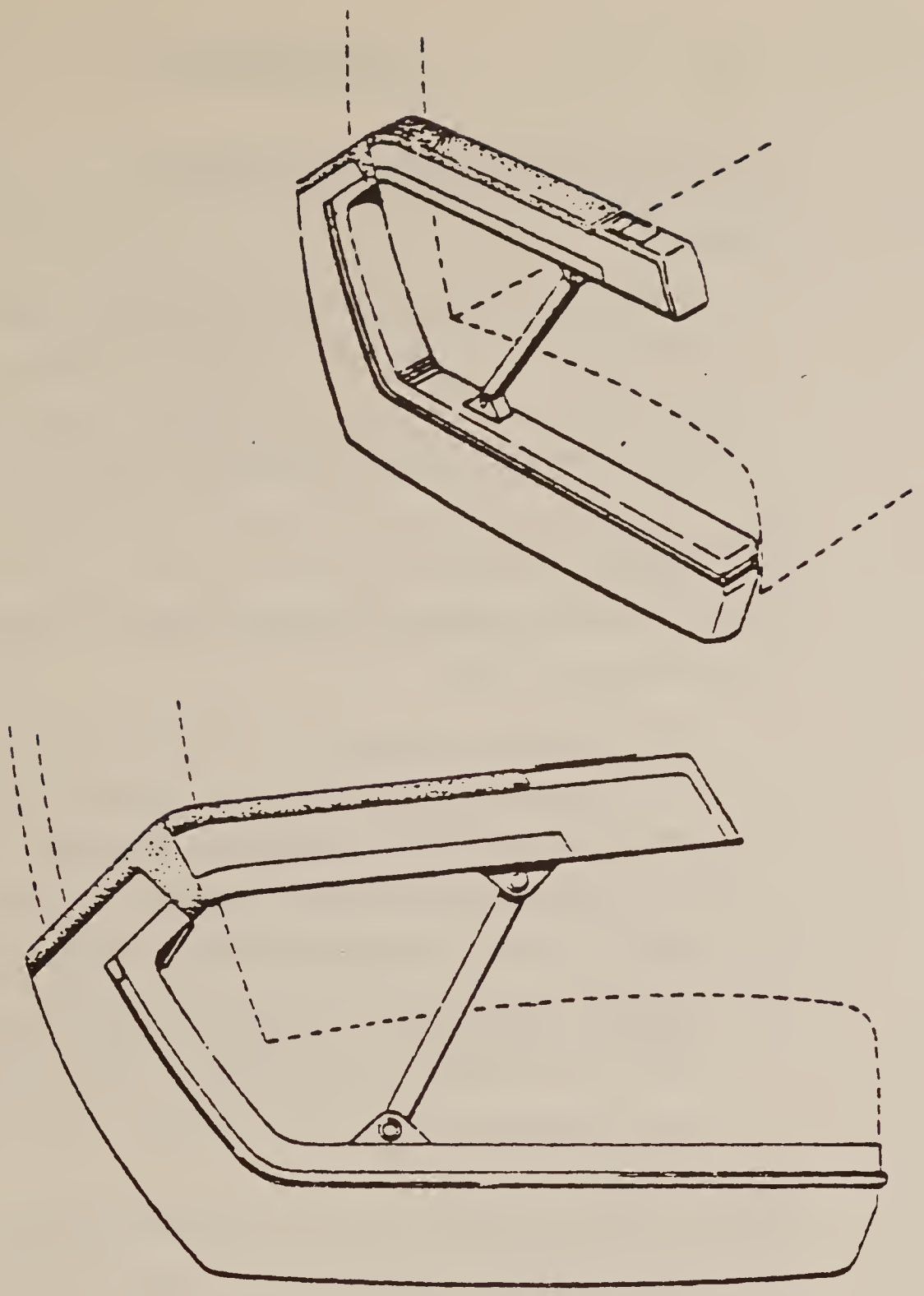
UOP INC. PASSENGER SEAT
WITH MOVABLE AISLE ARM REST

FIGURE B-2

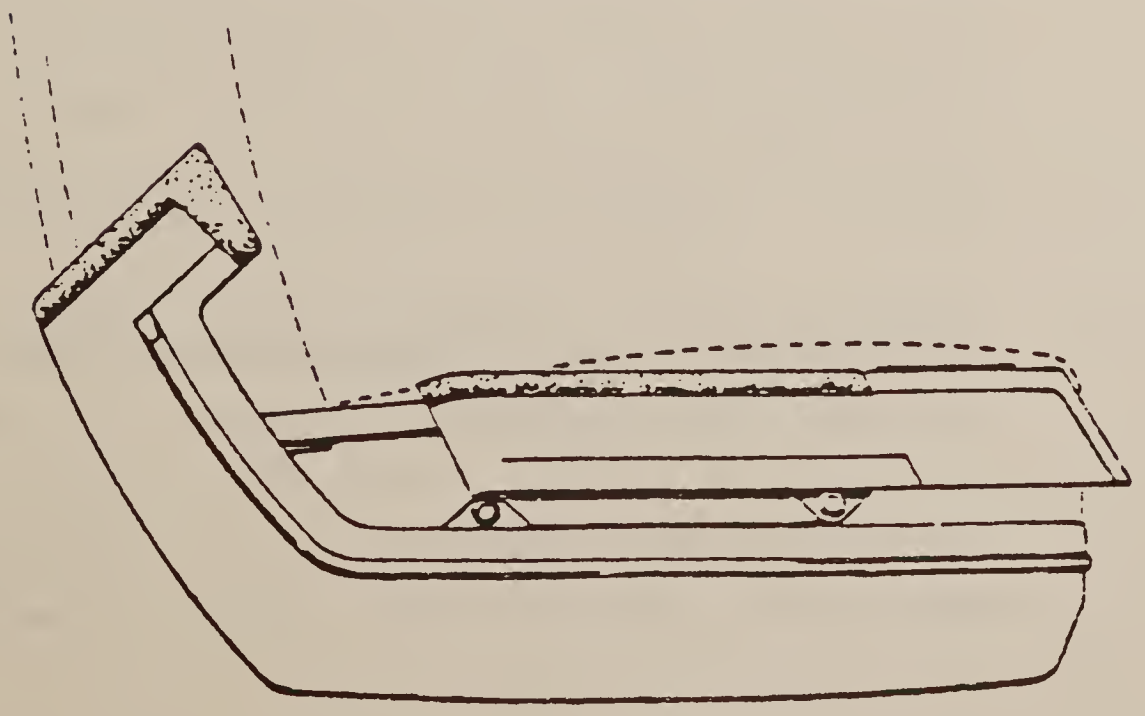


WEBER AIRCRAFT PASSENGER SEAT
WITH MOVABLE ARM REST

FIGURE B-3



ARMREST
DEPLOYED



ARMREST
STOWED

AIREST 2000 HANDICAP ENDBAY
FIGURE B-4

APPENDIX C

C. LAVATORY ACCESS PROVISIONS

C. 1 General

The access provisions are suggested to ease entry/exit of an airborne wheelchair to/from the lavatory. Concepts for ramps are described in the following two sections; the lavatory doorway size in Section C-4.

C. 2 Threshold Ramps

There are two types of lavatory entries encountered in passenger aircraft:

1. Conventional Lavatory - The floor is at the same level as the passenger cabin floor, Section C. 2. 1. A threshold strip separates the floors and acts as a barrier to retain liquid spillage within the lavatory. The threshold strip height varies between 1/4 and 1/2 inches.

2. Modular Lavatory - The floor within this lav is 1/2 to 3/4 inches above the passenger cabin floor level. In most applications, the threshold strip is not used.

C. 2. 1 Threshold Ramp for Raised Threshold Strip

This type of ramp, Figure C-1, . 032 stainless steel or equivalent, is placed over the threshold strip in preparation for wheelchair entry. Use of the ramp reduces the effort required to translate over the threshold. The ramp is stowed when not in use.

C. 2. 2 Threshold Ramp for Modular Lavatory (Raised Floor)

The slab ramp, Figure C-2, is required in order to bring a wheelchair to the level of the modular lavatory floor. Suggested ramp construction - honeycomb panel, aluminum or fiberglass face sheets, with ramp slope of 1:6. The ramp is stowed when not in use.

APPENDIX C

Permanent installation of the ramp under passenger cabin carpeting is not recommended in that the carpeting hides the ramp incline and may lead to passenger tripping due to dissimilarity in floor levels.

C. 3 Threshold Joint Strip, Conventional Lavatory

The raised threshold strip may be replaced by a joint-strip, Figure C-3, to cover the gap which will exist between cabin and lavatory floors. This concept eliminates the need for a threshold ramp.

C. 4 Doorway Size

The suggested airborne wheelchair width at arm rest level is 17 inches in order to satisfy the minimum door widths 17-3/4 inches encountered in passenger aircraft, including bi-fold doors. Figure C-4 provides dimensional clearances of various lavatory door configurations.

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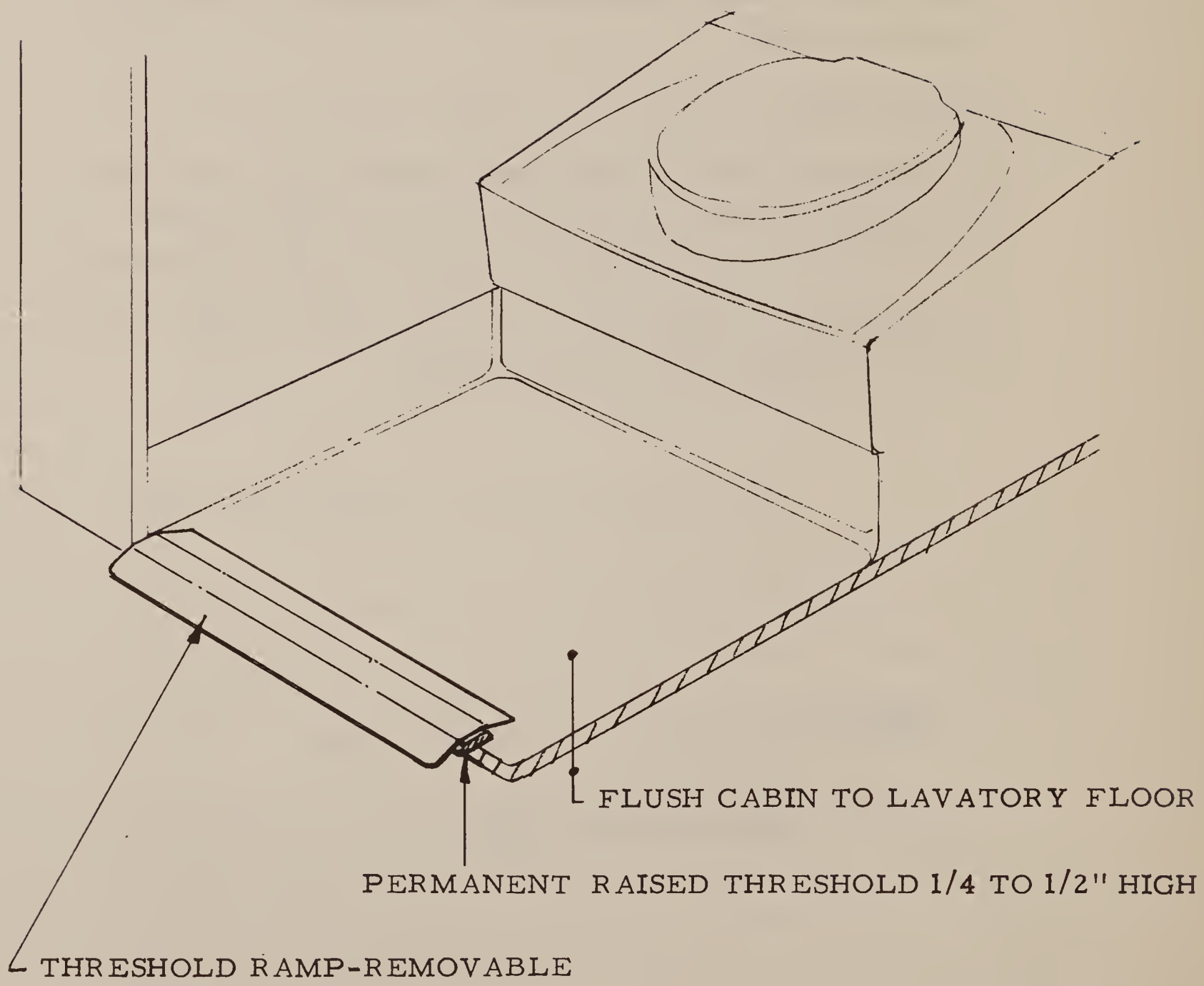
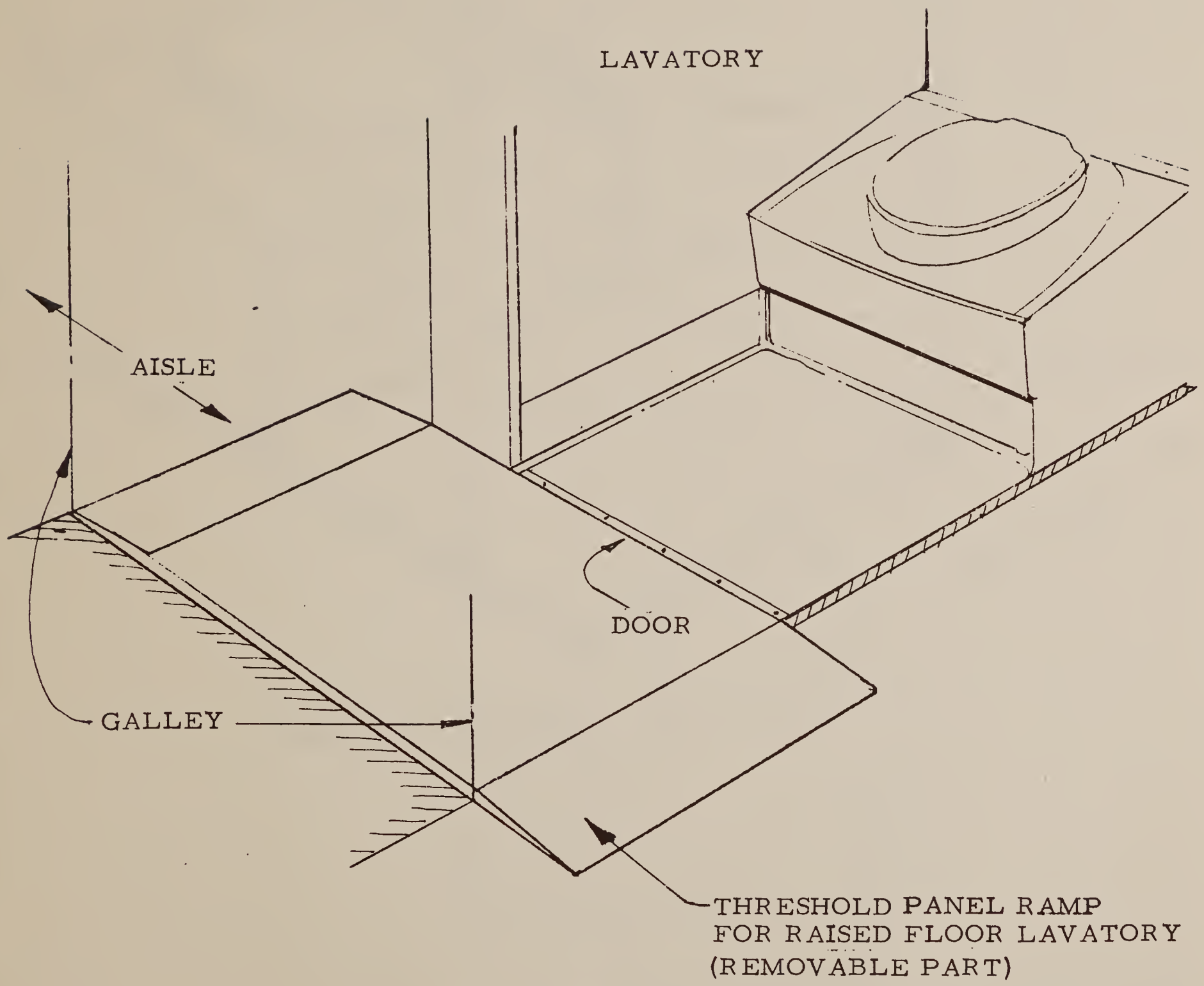
APPENDIX C



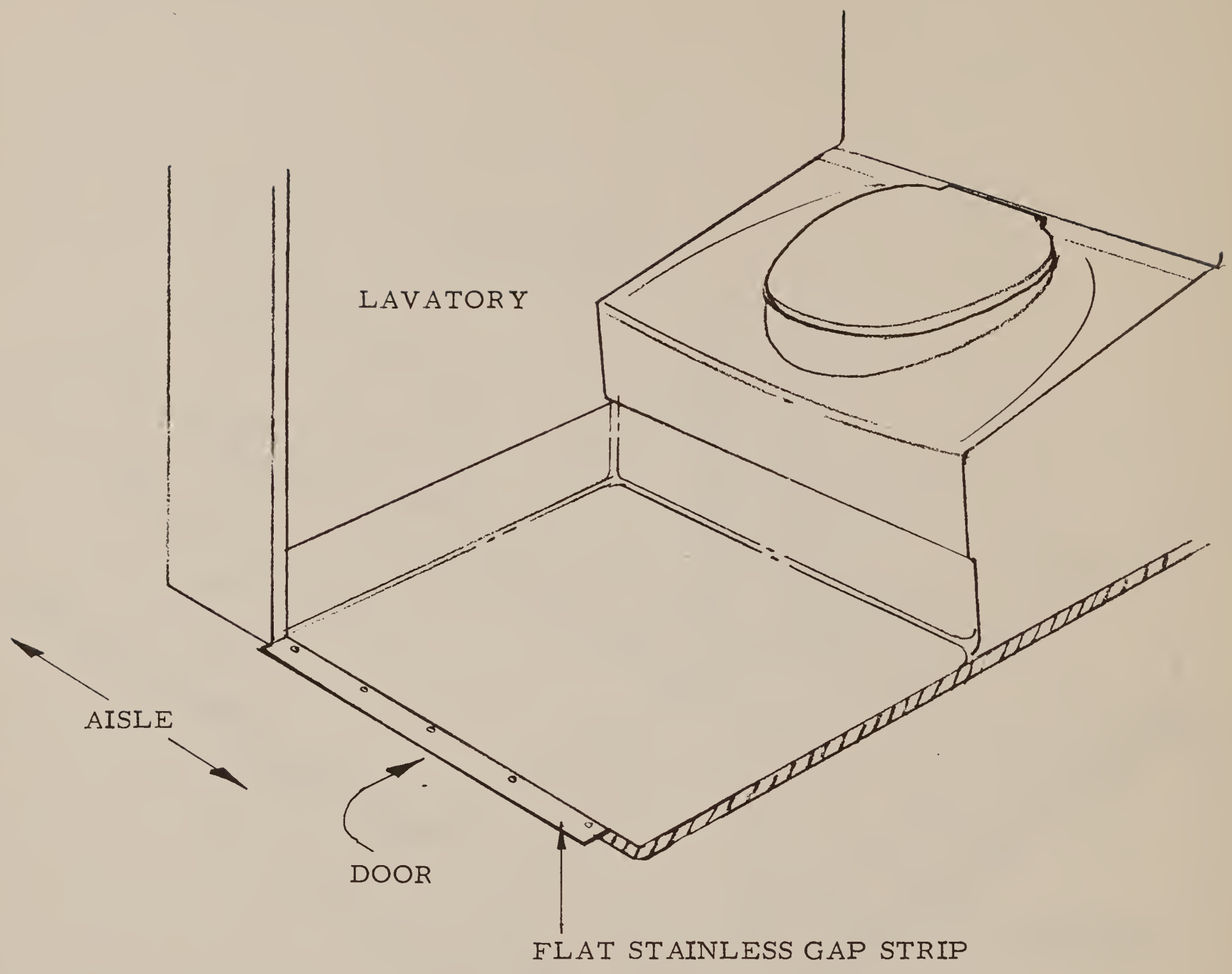
LAVATORY THRESHOLD RAMP
FIGURE C-1

APPENDIX C

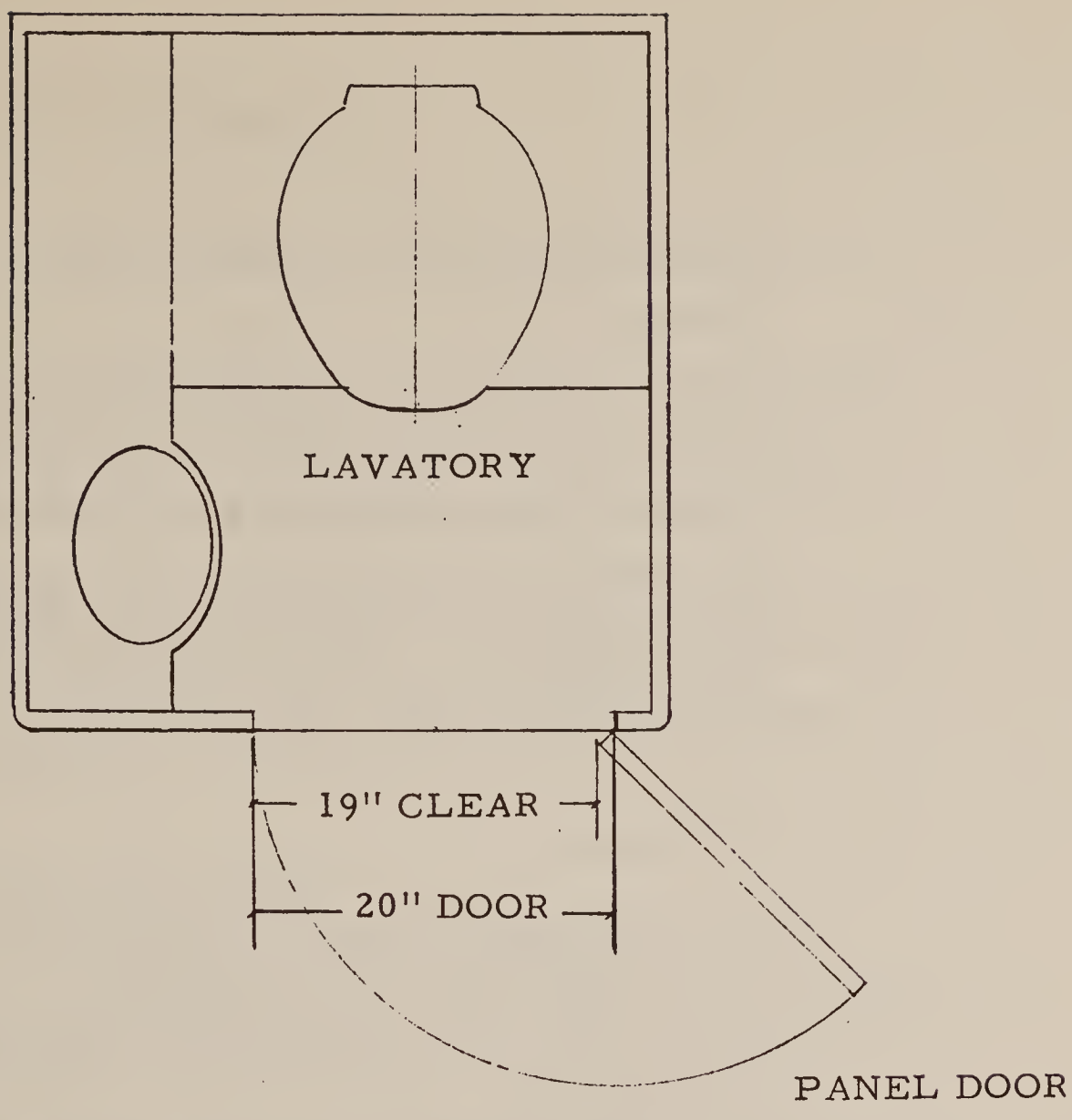


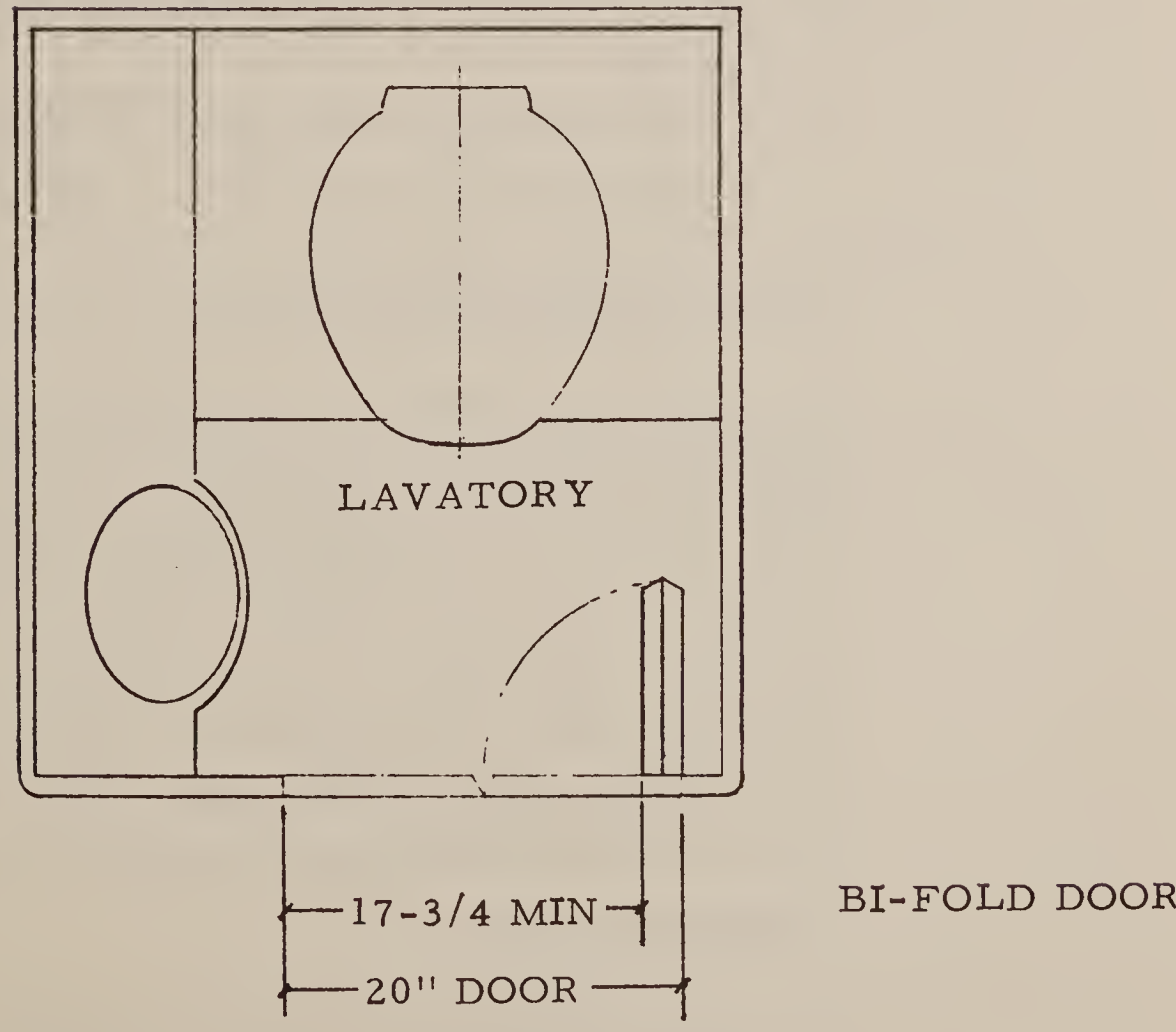
LAVATORY THRESHOLD PANEL RAMP

FIGURE C-2



LAVATORY THRESHOLD JOINT STRIP
FIGURE C-3





LAVATORY DOOR SIZE
FIGURE C-4

APPENDIX D

D. LAVATORY INTERIOR PROVISIONS

D. 1 General

The TARC Project Group has endeavored to meet the requirements of the disabled within a lavatory while maintaining existing configurations with minimum change, thereby satisfying the needs of all passengers. This approach realizes several advantages over modifying a single "designated" lavatory specifically for use by the handicapped passenger. (See clarification of designated lavatory given in Section D. 2).

Advantages:

1. Other lavatories are available if the "designated" lavatory is closed due to a malfunction.
2. Provisioning a lavatory for use by the disabled is minimal.
3. Other lavatories are available when groups of disabled travel.
4. As the numbers of traveling disabled increase, lavatory capability will be available. Additional provisioning not required.

D. 2 Support/Grab Bar Provisions

The one item required by a limited number of the disabled is a specially designed support/grab bar shown in Figure D-1. Tests have shown that the assist handle, which is available in all lavatories, does not meet the requirements of all disabled persons. Therefore, it is recommended that the support/grab bar installation be provided in a "designated" lavatory, with an appropriate symbol on the door. The addition of this one item will be the only difference between all lavatories and the "designated" lav.

Test and evaluation of lavatory hardware currently available indicates that due to the size of lavatories, the majority of the

equipment is appropriately located for most handicapped users. Special cases do exist, but relocation of hardware to meet these limited situations place other users at a disadvantage. Use of equipment aids provided in the Aid Kit for the Disabled, Section F, overcome these shortcomings in hardware location.

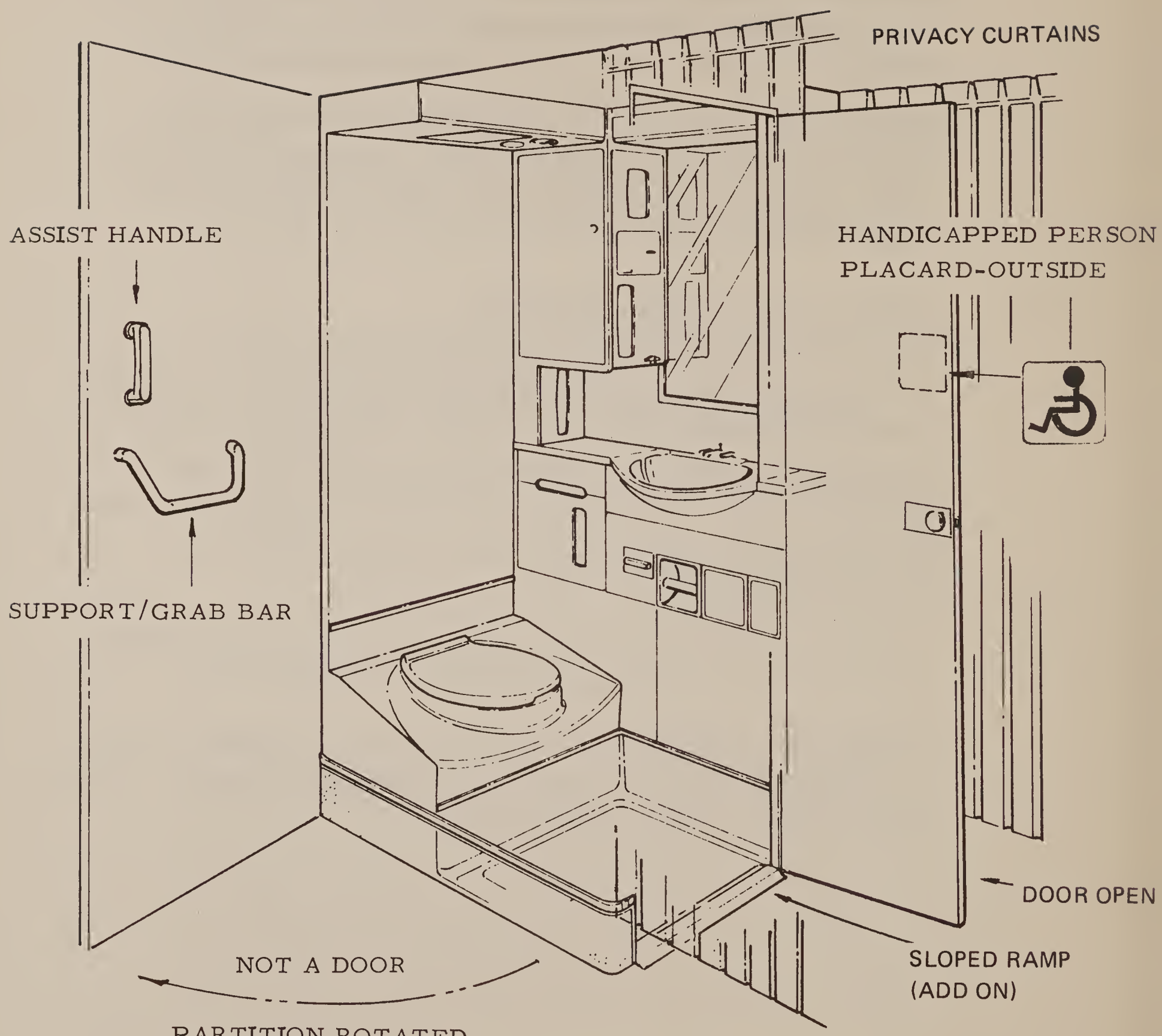
Naturally, in new design, lavatory hardware locations will be influenced by the findings of this study, by placing the hardware within reach of the handicapped user, while meeting the needs of the other passengers.

D. 3 Chair to Toilet Transfer Provisions

Many of the disabled have the capability to transfer from the airborne wheelchair to the toilet rather than using the translating feature of the wheelchair. This transfer may be accomplished by moving the wheelchair into the lavatory with the occupant facing the toilet. The transfer to the toilet is accomplished using the assist handle, support/grab bar, or sink counter, or a combination of these.

Transfer to the toilet using the University of Virginia wheelchair system may be accomplished in a similar manner.

Both the Fulton Airport Chair and the Everett & Jennings Aircraft Passenger Chair lack the capability of entering the lavatory. Hence, chair to toilet transfer is not possible.



LAVATORY INTERIOR MODIFICATION

FIGURE D-1

APPENDIX E

E. CURTAIN/DOOR CLOSE-OFFS IN THE VICINITY OF THE LAVATORY

E. 1 General

The purpose of close-offs is to provide a private area outside the lavatory. This space is needed for a handicapped person's attendant and/or a staging area for some unclothing and maneuvering. Room is also needed in the preparation of a wheelchair translation over the toilet seat. Concepts for close-offs are described in the following two sections.

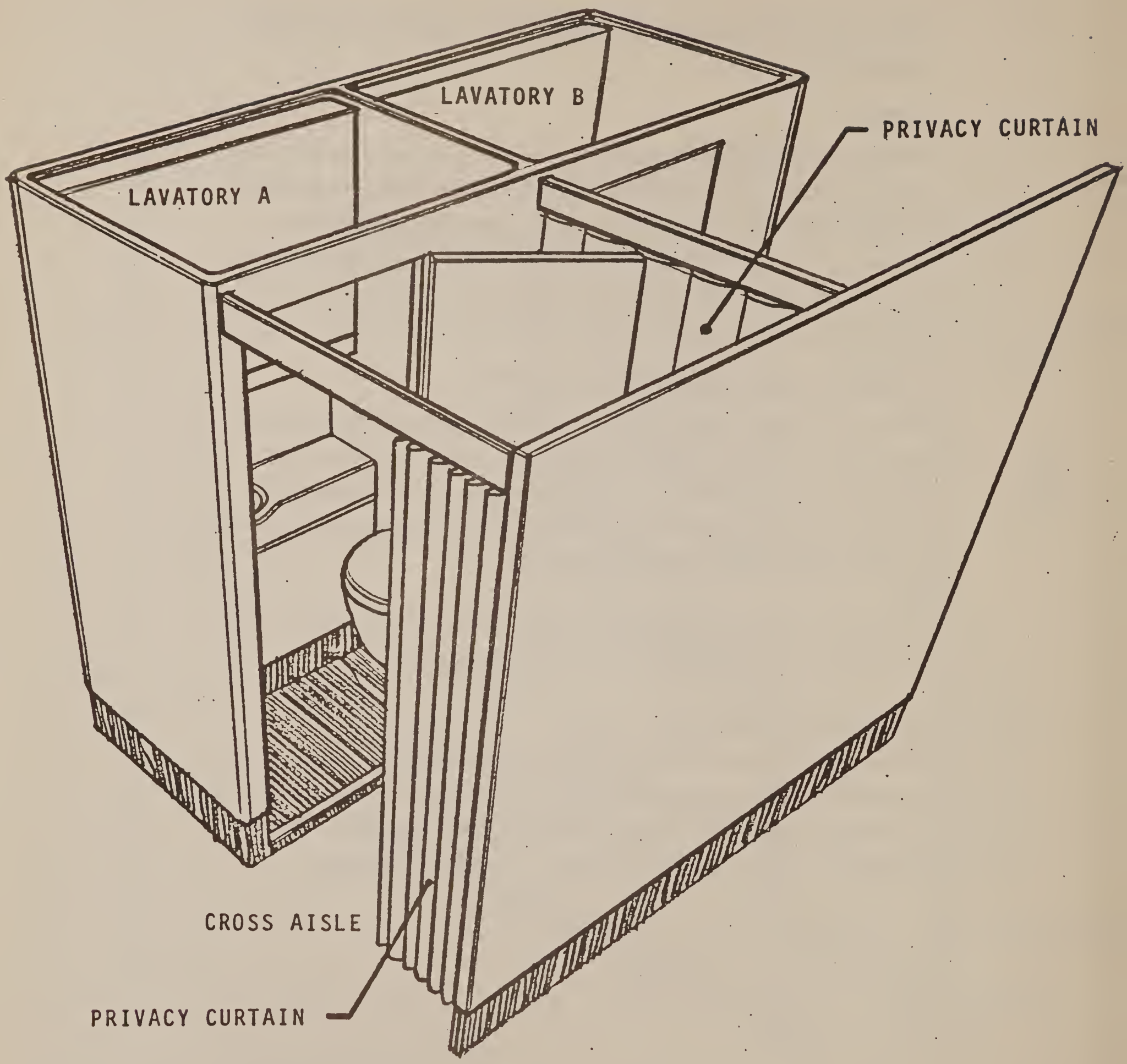
E. 2 Curtain Concept and Proposed Operation

Figure E-1 shows two privacy curtains, one separating the cross aisle between the two lavatory doors, and the other closing the cross aisle at the main aisle. By closing both curtains a privacy area is created outside one lavatory leaving the other open for another occupant.

Figure E-2 shows a privacy curtain pulled along the main aisle to provide a privacy area outside the lavatory.

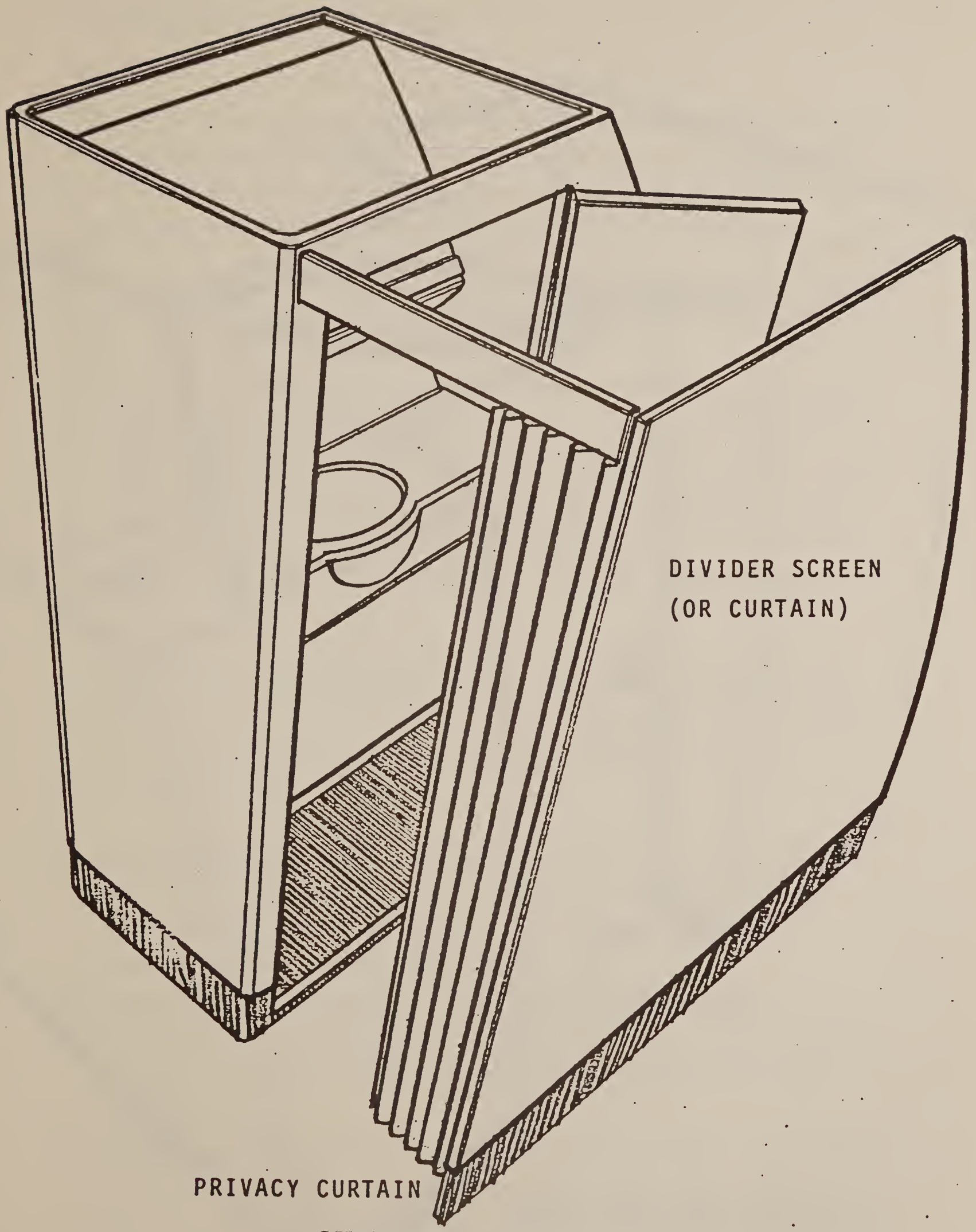
E. 3 Door or Panel Concept

Figure E-3 shows two lavatories located opposite each other. The doors are opened and locked to the opposite wall to provide a privacy area. The disadvantage of this concept is that it closes the other lavatory for use by another occupant.



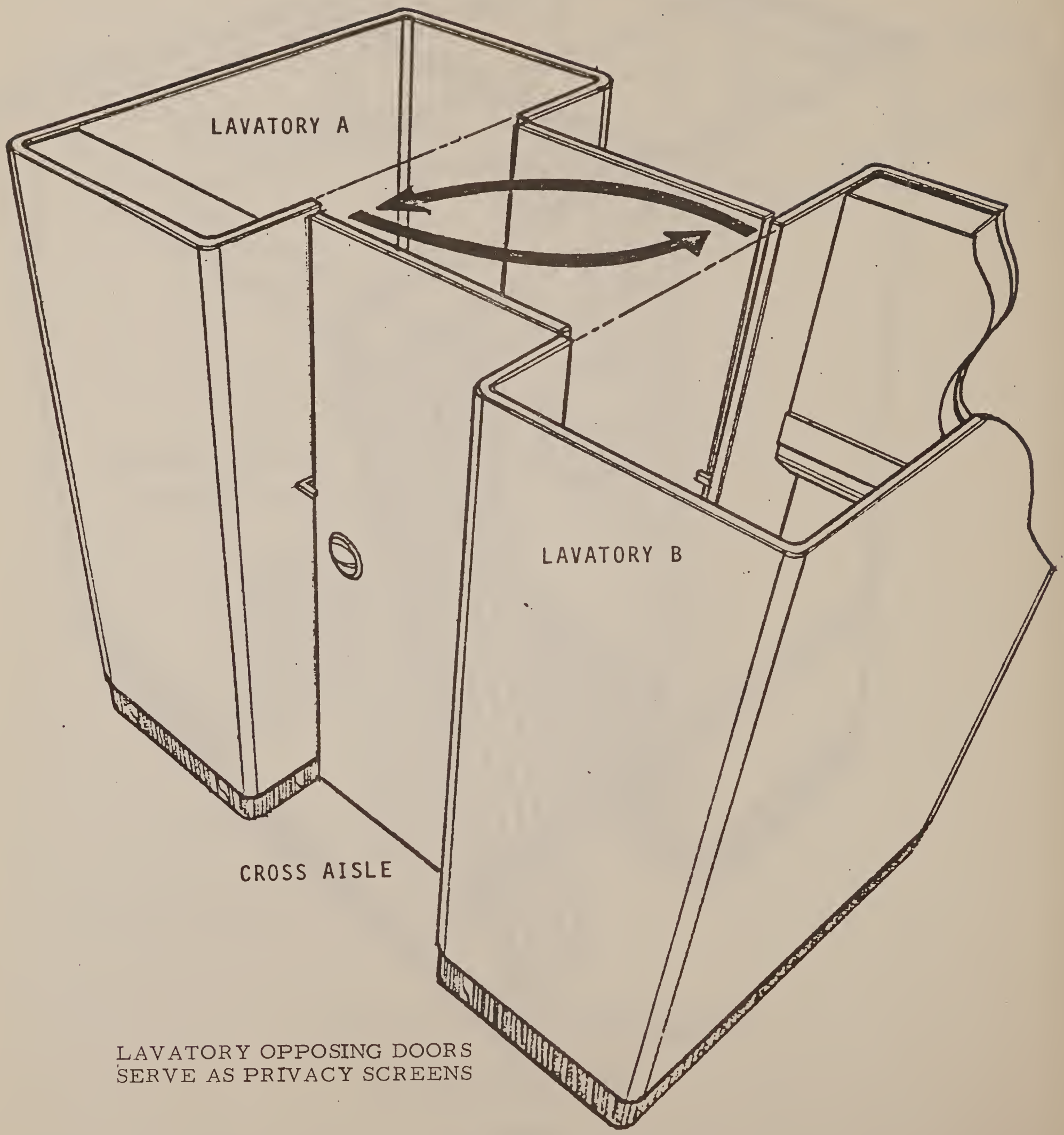
SINGLE LAVATORY PRIVACY
CURTAINED IN DOUBLE COMPLEX

FIGURE E-1



OUTBOARD LAVATORY
CURTAIN CLOSE-OFF

FIGURE E-2



LAVATORY OPPOSING DOORS
SERVE AS PRIVACY SCREENS

FIGURE E-3

APPENDIX F

F. AID KIT FOR THE DISABLED

F. 1 General

The Aid Kit for the Disabled is presented here as a suggested item of equipment available to the disabled passenger. Elimination of this kit and its function, reverts the operations to be performed to the flight attendant or the disabled passenger's attendant.

Provisioning the kit may be accomplished in several ways. One is given here. Many more are possible.

The kit size described is 8 x 10 x 12 inches. The dimensions may be varied to suit customer requirements. Refer to Figure F-1 for details. One kit will service six passengers. Size and number of items per kit is left to the discretion of the customer; likewise the number of kits. As noted on p. 13 of this report, kits owned by the user have several advantages, including customization.

F. 2 Lavatory Aids

Use of the aids eliminates the need to relocate existing lavatory hardware. In the future lavatory design may eliminate the need for some of the items described. Refer to Figure F-2 for illustrations of Aids.

1. Reaching Device - For disabled passengers with limited arm extension, the reaching device provides a means of using hardware within the lav such as the attendant call button, towel dispenser or other devices.
2. Emergency Call Adapter - Prior to use of the lavatory, a call adapter may be fastened to the call button. This extension allows actuation of the call button for the handicapped with limited reach.
3. Lighting Adapter - Most aircraft lavatory lighting is controlled by the latch which locks the door. The door must remain open where a personal attendant is assisting. The lighting adapter is inserted into lock door striker recess to activate the lights.

4. Faucet Adapter - Many of the disabled have limited hand functions or the use of one hand. By slipping the adapter over the faucet handles it is possible to actuate hot and cold water taps simply by applying pressure to the faucet adapter.

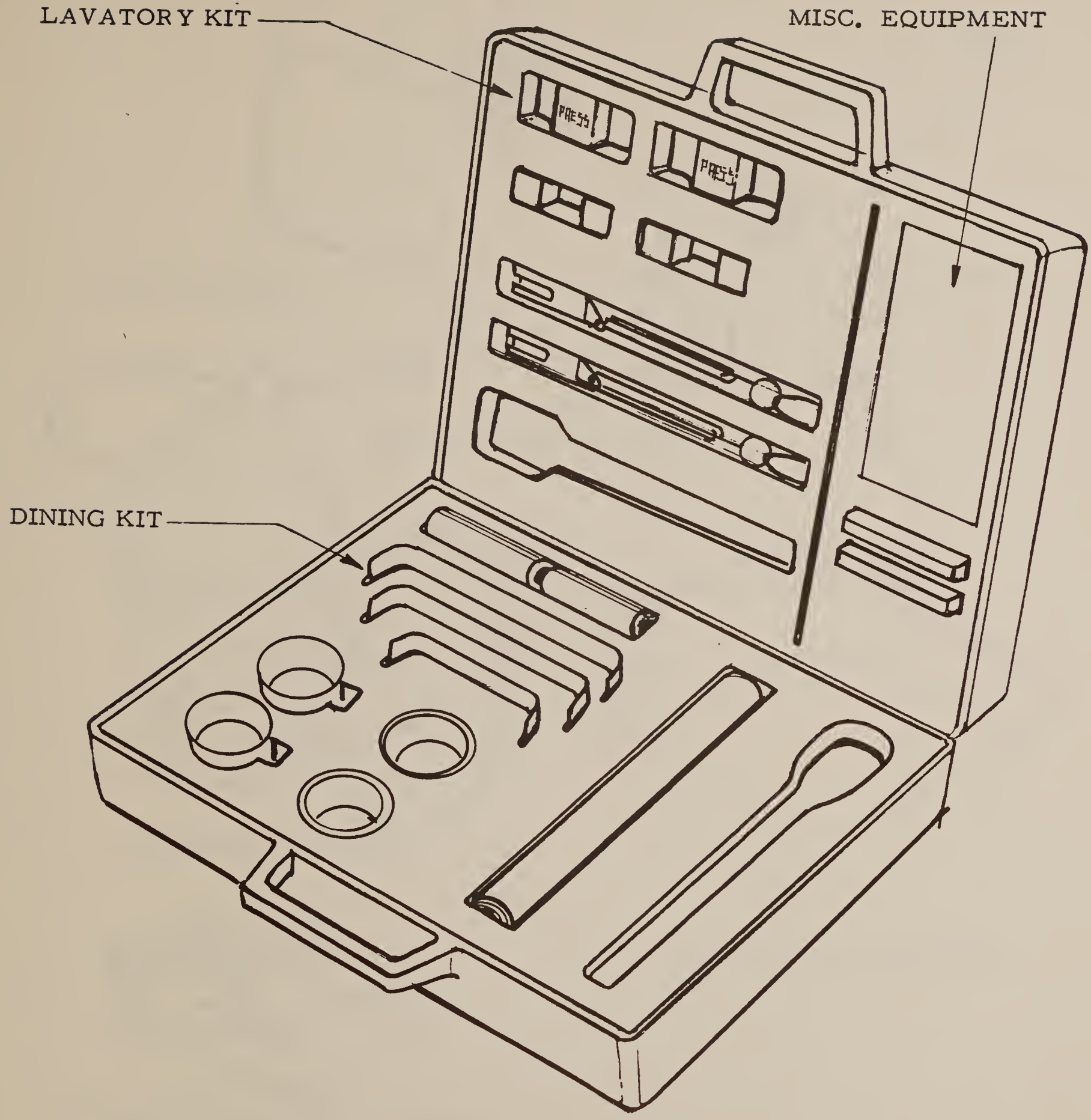
F. 3 Dining Aids

For those people with restricted hand functions, such as gripping of utensils, the kit aids provide a solution. For example, by slipping an adaptive device over utensil handles, it is possible to grip the utensil and to proceed with eating, Figure F-3.

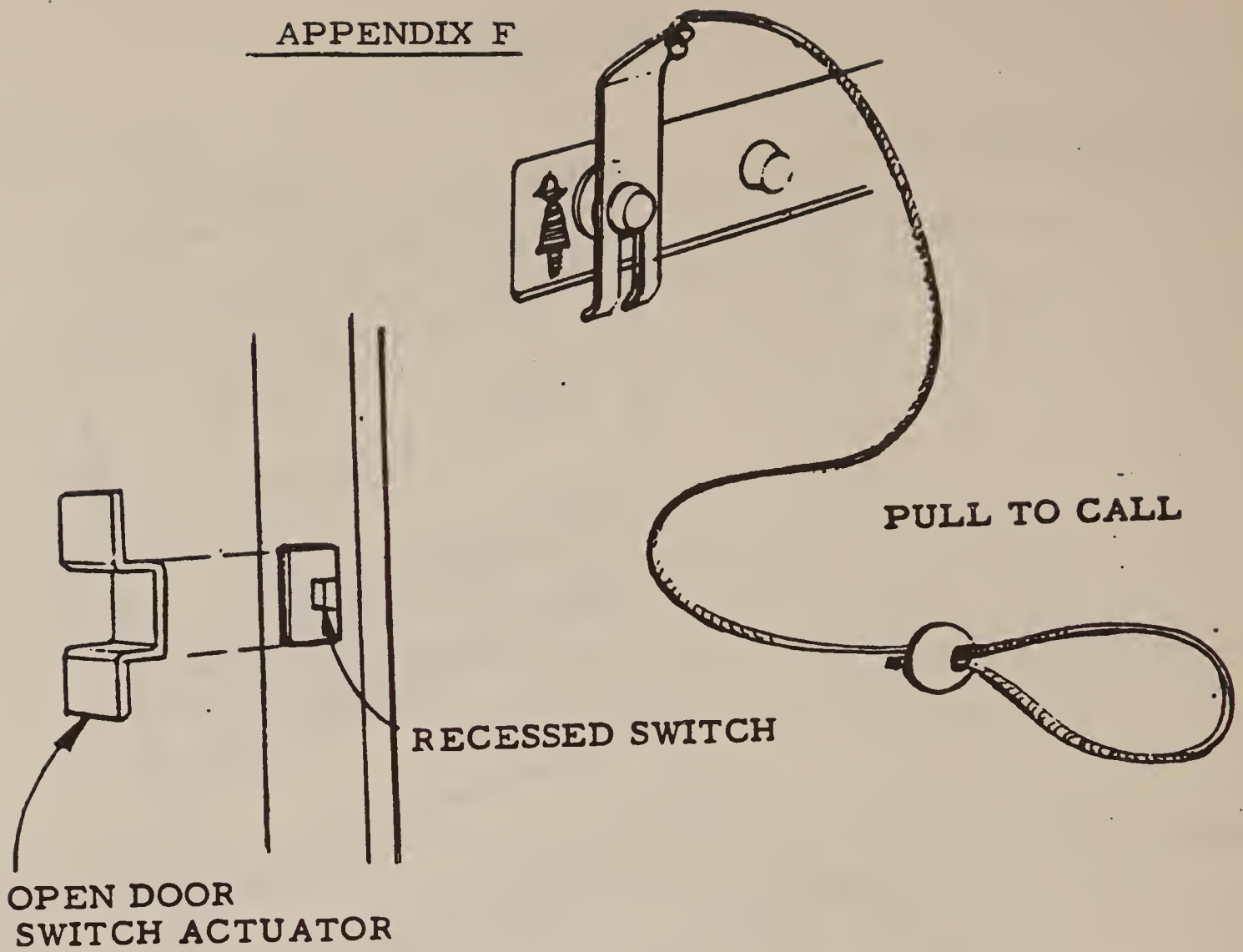
1. Tray and Plate Guards - These devices allow a person limited to the use of one hand to use the plate guard to trap food so that a utensil may be used more effectively in eating.
2. Adaptive Devices for Eating Utensils and Cup - Refer to Figure F-3 for the illustration of several of the adaptive devices.
3. Placemat for Securing Food Tray to Support Surface - Tray movement is a problem, particularly for the disabled. By positioning the placemat on the support surface prior to the arrival of the food tray, tray slippage will be eliminated. The placemat, with mild adhesive surfaces, both sides, is easily removable for clean-up.

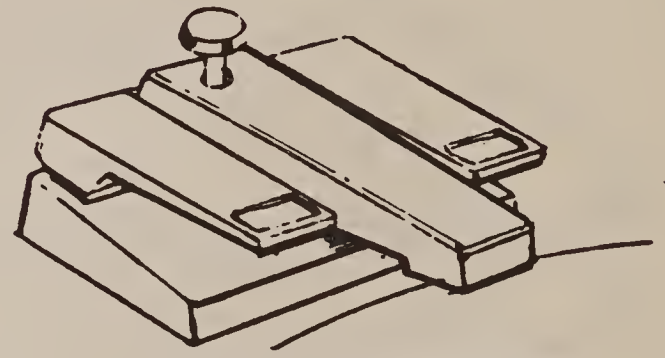
F. 4 Miscellaneous

Information Booklet - The disabled passenger may have anxieties concerning the use of facilities aboard an airplane. An illustrated booklet is suggested for inclusion in the aid kit, listing contents and use of items within the aid kit.

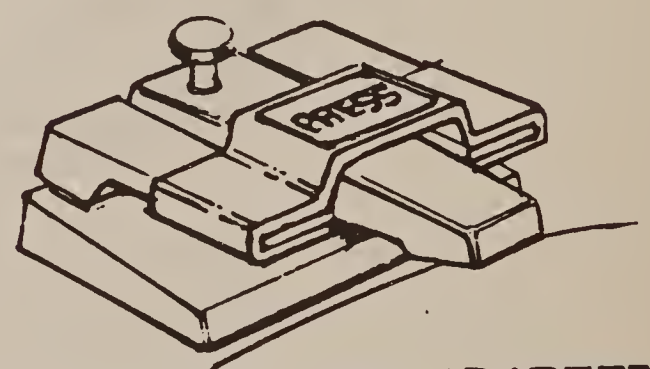


AID KIT FOR THE DISABLED
FIGURE F-1





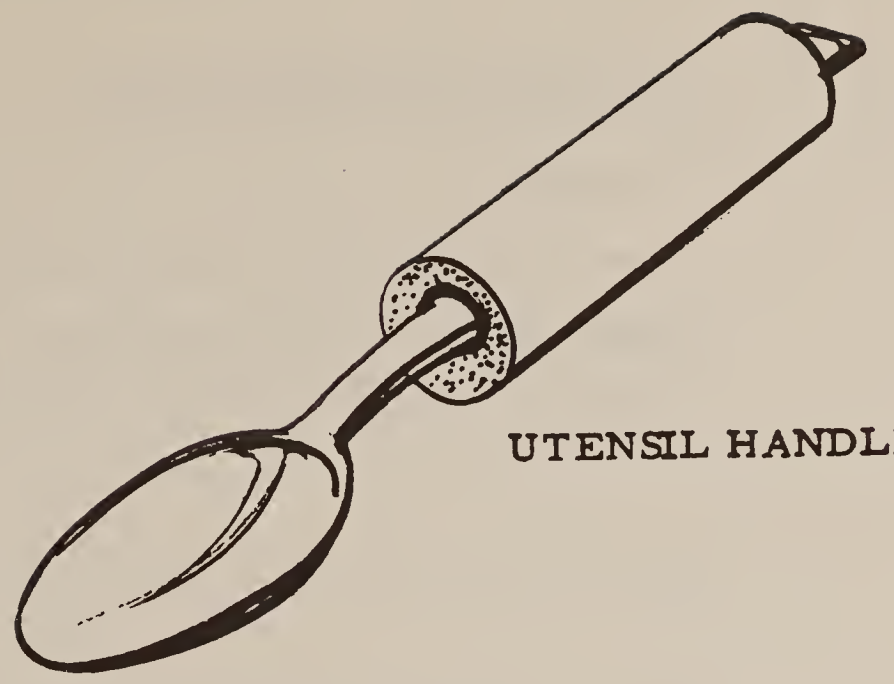
TYPICAL FAUCET



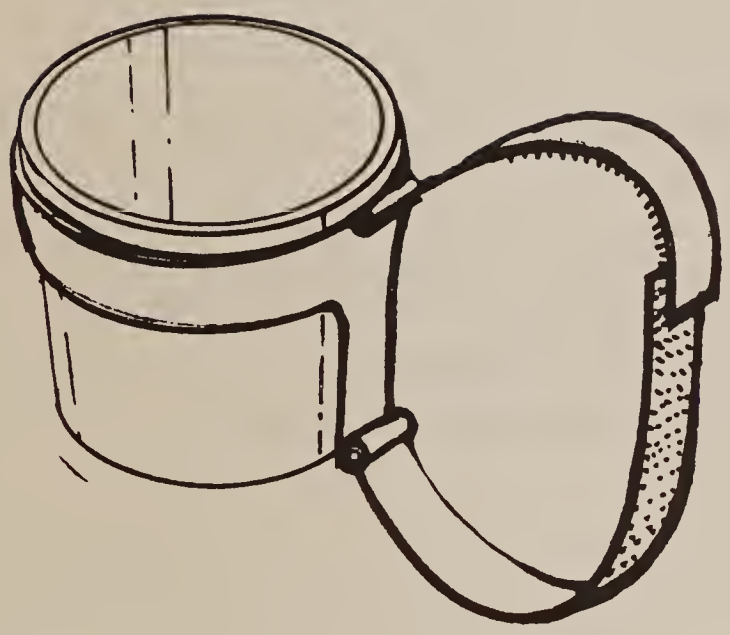
FAUCET PRESS DOWN ADAPTER

AID KIT - LAVATORY EQUIPMENT

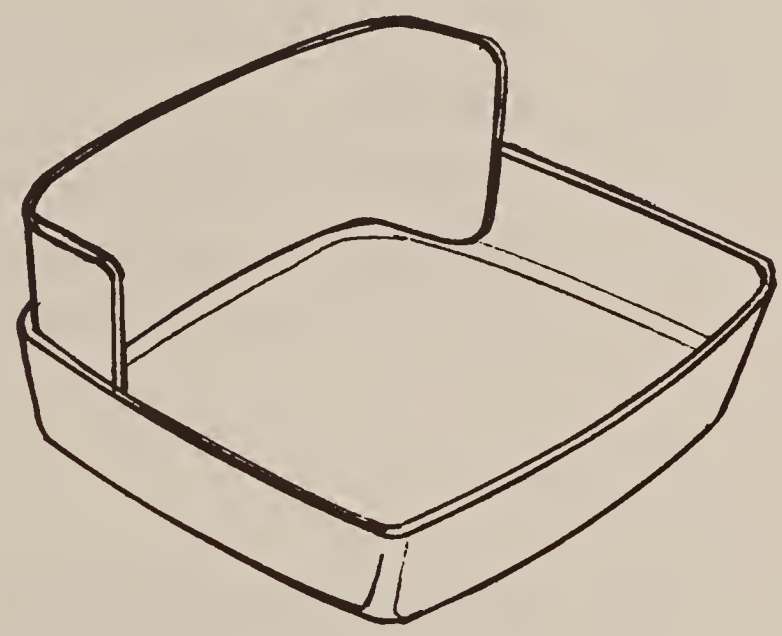
FIGURE F-2



UTENSIL HANDLE



CUP HOLDER VELCRO STRAP



CLIP ON PLATE GUARD

AID KIT - DINING EQUIPMENT

FIGURE F-3

APPENDIX G

G. AIRBORNE WHEELCHAIRS

G.1 General

Several airborne wheelchairs have been developed to meet the needs of the disabled traveler. The matrix provided, Table G-1, lists the candidate chairs, their features and limitations.

G.2 Carrier Aircraft Airborne Wheelchair

G.2.1 General

The Carrier Aircraft Airborne Wheelchair, Figure G-2, is designed to accommodate the disabled aboard all wide-body and standard-body passenger aircraft.

G.2.2 Description and Operating Envelope

Figure G-2 depicts the operating envelope of the Airborne Wheelchair in various modes.

Other features of the wheelchair design:

1. Telescoping handles (front face) which can be adjusted for maneuvering in confined quarters.
2. Retractable handles located in the seatback for use in maneuvering and lifting over minor obstacles.
3. Curved headrest for head support.

4. Shoulder harness to steady and support the occupant.
5. Seatback recline of five degrees to aid occupant in making clothing adjustments and/or to ease the discomfort associated with a fixed vertical seatback.
6. Foldable for stowage into a size of 10 x 17 x 21 inches.
7. Seat height from floor surface to top seat bottom is 22-1/2 inches.
8. Seat assembly translates over the toilet with the chair occupant remaining seated.
9. Modifications to the lavatory are not required in order to accommodate the chair.
10. Weight, 45 lbs.
11. Is compatible with both the bench and conventional type of toilet shroud. (bench type shown in Figure D-1).

APPENDIX G

G. 2. 3 Proposed Operation

A typical application of the airborne wheelchair is presented herein. Many variations to this procedure are possible, influenced by the person's degree of disability. Some may wish to enter the lavatory and transfer from the wheelchair to the toilet seat; others, because of physical limitations, will prefer to remain seated throughout the procedure, that is, from the passenger seat to the lavatory toilet and return.

The most complicated chair function involves the quadriplegic. The procedure remains similar, however, the personal attendant assists the chair occupant by performing the functions normally exercised by the wheelchair occupant.

A Suggested Operating Procedure

The Carrier Aircraft airborne wheelchair may be stowed on board or brought aboard the aircraft as needed.

1. The airborne wheelchair is removed from its stowed position within the aircraft, erected by the cabin service crew and stowed in the lavatory, with casters locked, for takeoff and landing. This requires FAA approval.

2. The flight attendant(s) (preferably two) move the wheelchair from its parking place to the aircraft boarding entry. The wheelchair occupant is transferred from the airport wheelchair onto the airborne wheelchair.

3. The passenger is then moved down the aisle to a passenger seat. The wheelchair and the passenger seat armrests are moved out of the way. Again, the passenger is assisted by the flight attendant in accomplishing the transfer.

4. The airborne wheelchair is parked in a lavatory and its front casters locked, for takeoff and landing.

5. As soon after takeoff as applicable, the wheelchair is parked and casters locked in a convenient doorway until needed. For added safety the chair should be tethered to nearby structure during periods of turbulence.

6. For moving the passenger from the passenger seat to the lavatory, unlock casters and move the chair opposite the designated passenger. Armrests are raised and the chair toilet seat cover raised to prepare the wheelchair for the lavatory mode. Passenger transfer is then accomplished. Lower wheelchair armrest, secure the passenger to the chair using the chair harness and proceed to the lavatory area.

7. At the designated lavatory, the attendant backs the wheelchair into position against the toilet, locks front casters and instructs the chair occupant regarding the operation of the wheelchair translating toilet seat assembly. The chair occupant first extends the chair-to-toilet stabilizer and locks it in place. Next the occupant moves the translating seat assembly over the toilet. The harness is then stowed. Once this operation is completed, the flight attendant exits the lavatory, closes the lav door and is not involved until after the occupant has used the call button to signal completion of his/her bathroom functions.

8. For returning the passenger to his/her seat, reverse the sequence of steps 6 and 7, that is, step 7 followed by 6. The chair is then returned to the doorway parking space and casters locked.

9. For getting the passenger to the exit for deplaning, the sequence of steps 1 through 4 is reversed.

10. Wheelchair maintenance service is performed by cabin services prior to stowage. Specifically, the wheelchair translating toilet seat and splash guard shroud and adjacent seat structure is wiped down and sanitized, as applicable.

11. Use of the equipment aids, packaged in the Aid Kit for the disabled, for use inside the lavatory, in conjunction with the chair, is described in Appendix F.

G.2.4 Capabilities/Limitations

Capabilities

1. Is of minimal dimensions to permit aisle travel and access into an aircraft lavatory.
2. Is capable of translating over the lavatory toilet with the chair occupant remaining seated.
3. With minor adjustment to the chair stabilizer, the translating seat assembly will interface with the toilet shroud surface, regardless of the passenger aircraft to which it is assigned.
4. Is collapsible for stowage aboard an aircraft.
5. Is easy to move/maneuver and is relatively stable under controlled conditions.
6. Is usable in lavatories other than the designated lav for disabled.

Limitations

1. Is not suggested for use in transporting chair occupants up aircraft boarding stairways. (The airport chair is designed to serve this function)

APPENDIX G

G. 3 Fulton Airport Chair

G. 3. 1 General

The Fulton Airport Chair, Figure G-3, is designed to function within the airport facility and may be used to transport an occupant into an aircraft via a stairway, when a jetway is not available. With outriggers stowed, navigation within the aircraft cabin aisleways is possible.

G. 3. 2 Description and Operating Envelope

The size and shape of the airport chair is shown in Figure G-3, in the transport, stretcher and stowed modes.

Other features of the airport chair design:

1. Headrest for head support.
2. Shoulder harness to steady and support the occupant.
3. Seatback recline of approximately eighty degrees (80^{o}), to aid occupant in making clothing adjustments.
4. Foldable for stowage into a size of 8 x 36 x 41 inches.
5. Seat height from floor surface to top of seat bottom is seventeen (17) inches.
6. Usable as a stretcher, requiring a floor area of 20 x 75 inches.

G. 3. 3 Proposed Operation

The airport chair, as the name implies, is designed for use throughout the airport terminal area and for transporting the disabled into the aircraft from ground level where a jetway is not available. The typical sequence presented here has many variations that the reader may wish to explore.

A Suggested Operating Procedure

The Fulton chair is stowable in areas where conventional wheelchairs are located. Operations involving airport personnel are suggestions only.

1. The Fulton chair is unfolded and outriggers extended on either side for added stability.
2. Airport attendant proceeds to passenger arrival area (curb side) and disabled person is transferred into the airport chair.
3. Chair is moved from check-in areas, to the passenger waiting lounge, and into the boarding area. Should a delay in departure develop, the airport chair seatback may be lowered to the stretcher mode for passenger comfort.
4. For boarding the aircraft via the jet way, the wheelchair proceeds to the aircraft entry. Outriggers are retracted and the chair and occupant lifted by attendants over the aircraft entry threshold.
5. The chair can then proceed down the aisle to the passenger's assigned seat.
6. The Fulton chair is then returned to the airport chair parking area.

   Note: This chair could be stowed and used aboard an airplane within the capabilities expressed in section G. 3. 4.

7. For deplaning the Fulton chair is brought from the airport chair parking area to the aircraft and steps 1 through 7 repeated in reverse.

G. 3. 4 Capabilities/Limitations

Capabilities

1. Is of minimal dimension to permit aisle travel, when outriggers are retracted.
2. Is collapsible for stowage.
3. With outriggers extended, thereby increasing chair stability, the vehicle may be used to transport a disabled person from the street curb, throughout the air terminal and into the aircraft.
4. May be used as a stretcher when the seatback is lowered to a semi-horizontal position or to aid those who may require more of a horizontal position to dress/undress.

Limitations

1. Is not accessible into a lavatory - width of chair greater than door opening.
2. Has maneuvering limitations in restricted cross aisles.
3. Cannot position a disabled person over the toilet seat.

APPENDIX G

G.4 University of Virginia Wheelchair System

G.4.1 General

The University of Virginia Rehabilitation Engineering Center has developed a wheelchair system for use aboard passenger aircraft, Figure G-4. The design concept consists of an aircraft toilet with a sliding seat, used in combination with a wheelchair for inflight use.

G.4.2 Description and Operating Envelope

The sliding toilet seat is provided as an integral part of a bench type toilet shroud. It is maintained in the stowed (latched) position for use by other passengers. The frame extends from behind the toilet seat to a pair of legs extending down to the floor immediately in front of the shroud, one on each side of the toilet seat. The tubular members are positioned and shaped so as to serve as hand holds while sitting in the seat. Rollers are positioned at the base of the legs and at the rear of the toilet seat. Adjacent to the legs are keepers attached to the shrouds and securing the tubular frame with rings while allowing it to move forward and backwards. A further bracket at the front of the tubing supports the front of the toilet seat when the system is moved forward. The toilet has a normal appearance except for the handle-like tubes and the legs. The system allows the toilet seat to be moved forward approximately 16 inches which is close to the door opening in most aircraft washrooms. The seat can be moved to a midway position so the passenger can lean back as an aid to removing and replacing clothing or in reaching the wash basins.

The wheelchair is constructed of aluminum alloy tubing with a rigid seat and sling back panel. The front wheels are 8 inch Everest and Jennings wheels. The rear wheels are 4 inch Shepard casters. This arrangement allows room for a folding foot rest and avoids forward tipping of the wheelchair and occupant when obstructions such as door sills are encountered. By releasing two pins and pushing the

back forward and down the wheelchair collapses into a 14 x 28 x 9 inch package. It folds out by pulling up and extending the back.
The width below seat arm height is 17 inches. Seat belt type straps are used at the knee and chest for security. No head rest has been added, as yet. Because two wheels do not caster the wheelchair tracks well, but it cannot turn on its own center nor can it be moved sideways. The turning radius is approximately 18 inches. Brakes can be reached by the passenger or attendant. Wheelchair weight 15 lbs.

G. 4. 3 Proposed Operation

A Suggested Operating Procedure

The wheelchair will be stowed aboard the aircraft. At the request of the passenger it will be unfolded by a flight attendant and wheeled to a position adjacent to the passenger's seat. The aircraft seat arm rest will be folded, brakes applied to the wheelchair and the passenger transfers sideways, with or without assistance, to the wheelchair. Knee and chest straps are secured if the passenger so desires and the wheelchair is pushed by the flight attendant to a position opposite the open doorway. The attendant then reaches into the washroom and slides the seat forward and locks it. The passenger then transfers to the toilet seat using a pivot transfer with or without assistance, depending upon the disability. The attendant then demonstrates the seat lock and closes the door as the passenger pushes back into position. The passenger may select a mid-way position for undressing. On completion of the toileting and dressing the passenger operates the call button, the flight attendant moves open the door and moves the wheelchair into position. The passenger then transfers or is transferred, and the toilet seat is slid back into position. The passenger then returns to his seat and the wheelchair is folded and stored.

The toilet seat is used by other passengers in the normal manner.

G. 4. 4 Capabilities/Limitations

Capabilities

1. The wheelchair seat height is approximately the same height as the passenger seat for relatively easy transfers.
2. Is of minimal dimensions to permit aisle travel and access outside the lavatory door.
3. Is collapsible for stowage aboard aircraft.

Limitations

1. Two transfers are necessary, from the seat to the wheelchair and from the wheelchair to the toilet.
2. The designated lavatory is the only lav capable of accommodating the quadriplegic.
3. It is not suggested for use in transporting chair occupants up aircraft boarding stairways.
4. It is not compatible with the conventional type of toilet shroud. (versus bench type shown in Figure D-1).

G. 5 Everett and Jennings Aircraft Passenger Loading Chair

G. 5. 1 General

The Aircraft Passenger Loading Chair, Figure G-5, can be used as a transfer chair in airport lounges as well as an aircraft loading chair by way of the jetway or via the stairway.

G. 5. 2 Description and Operating Envelope

The Aircraft Passenger Loading Chair is designed for use in most types of commercial aircraft. Its size and shape are shown in Figure G-5.

Other features of the chair design:

1. Low back height enables attendant to lift person in and out of chair.
2. Lap and chest restraining belts.
3. Extended tipping levers and a luggage strap provides for carry-on luggage.
4. Seven (7) inch diameter casters for easy rolling on broadloom.
5. Drop-down arms for easy side transfer.
6. Makes 360° turns in narrow front entrance of aircraft.

G.5. 3 Proposed Operation

The Aircraft Passenger Loading Chair is designed for use throughout the airport terminal area. This chair eliminates the use of a transfer chair as the user can get from his/her own chair onto the Aircraft Passenger Loading Chair, then to the aircraft seat. Seat height of the chair is the same as the aircraft seats. The typical sequence presented here has many variations that the reader may wish to explore.

A Suggested Operating Procedure

The Aircraft Passenger Loading Chair is stowable in areas where conventional wheelchairs are located. Operations

involving airport personnel are suggestions only.

1. The loading chair is unfolded by the airport attendant who then proceeds to the passenger arrival area (curb side). The disabled person is transferred into the airport chair.
2. Chair is moved from check-in areas, to the passenger waiting lounge, and into the boarding area.
3. For boarding the aircraft via the jetway, the wheelchair proceeds to the aircraft entry. The chair and occupant are lifted by attendants over the aircraft entry threshold.
4. The chair can then proceed down the aisle to the passenger's assigned seat.
5. The wheelchair is then returned to the airport chair parking area.

NOTE: This chair could be stowed and used aboard an airplane within the capabilities and limitations expressed in G. 5. 4.

6. For deplaning, the Aircraft Passenger Loading Chair is brought from the airport chair parking area to the aircraft and steps 1 through 7 repeated in reverse.

G. 5. 4 Capabilities/Limitations

Capabilities

1. Is of minimal dimension to permit aisle travel.
2. Is collapsible for stowage.
3. The vehicle may be used to transport a disabled person from the street curb, throughout the air terminal and into the aircraft.

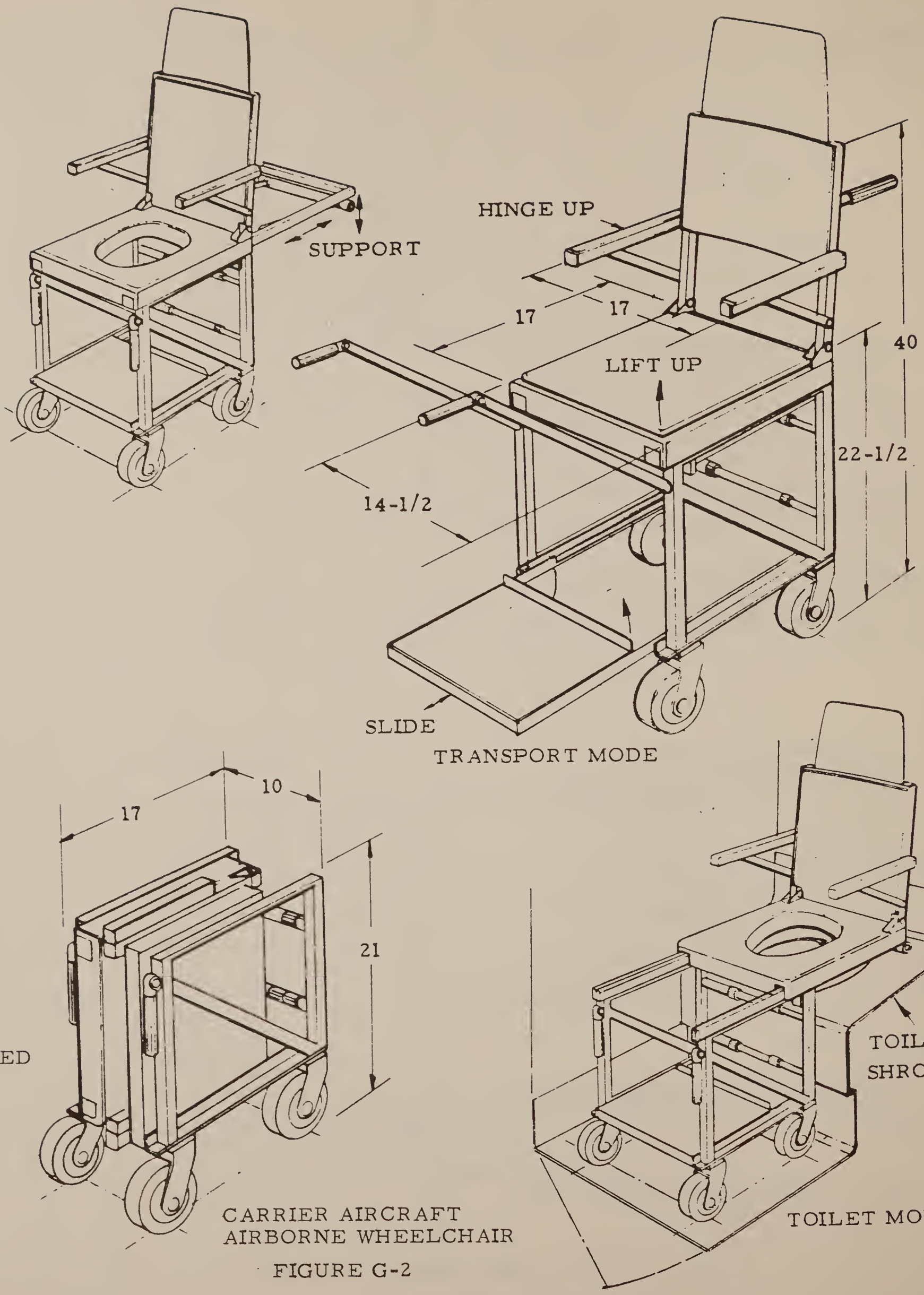
Limitations

1. Is not accessible into all lavatories because of maneuvering limitations in restricted cross aisles.
2. Cannot position a disabled person over the toilet seat.

WHEELCHAIR COMPARISON MATRIX	Model					
	Figure					
	G-2	G-3	G-4		G-5	
FUNCTIONAL CHARACTERISTICS	CARRIER AIRCRAFT AIRBORNE WHEELCHAIR	FULTON AIRPORT CHAIR	UNIVERSITY OF VIRGINIA WHEELCHAIR SYSTEM — AISLE CHAIR	UNIVERSITY OF VIRGINIA WHEELCHAIR SYSTEM — LAV SEAT	EVEREST & JENNING AIRC. PASSENGER CHAIR	
Seat Assy. Translates over toilet for quadriplegics & others who cannot transfer	X	-	-	X	-	
Chair can navigate within a minimum aisle width of 15" (FAR Part 25, Para. 25.815)	X	-	X	-	X	
Chest Restraining Belts	X	X	X	-	X	
Can enter lav from a minimum cross aisle width of 26"	X	-	X	-	-	
Can enter lav for those who are able to transfer from chair to toilet	X	-	X	-	-	
Capable of passing through a door width of 17 3/4"	X	-	X	-	X	
MEASUREMENTS & WEIGHTS						
Width at Seat Level	14 1/2	14 1/2	14 1/2	14 3/4	14	
Depth of Upholstery (seat top depth)	17	16	16	16	16	
Seat Height from Floor	22 1/2	17	17	18½	17	
Distance between arm rests	14 1/2	-	-	13¼	-	
Arm rest height from seat level	10	-	-	8	-	
Arm rest height from floor	30 1/2	-	-	26½	-	
Back upholstery height above seat	18	29	17	16½	-	
Length max. footrest/rigging, handles-stowed	17	25	17	38	16	
Length max. footrest/rigging, handles-extended	34	45	25	38	36	
Height-overall	40	46	37	35	-	
Width open overall	17	18	14 1/2	15	-	
Width folded	10	8	9	6½	-	
Chair can make a 360 degree turn within a minimum diameter of xx inches	30	48	36	55	-	
Net Weight	45	40	15	34	20	

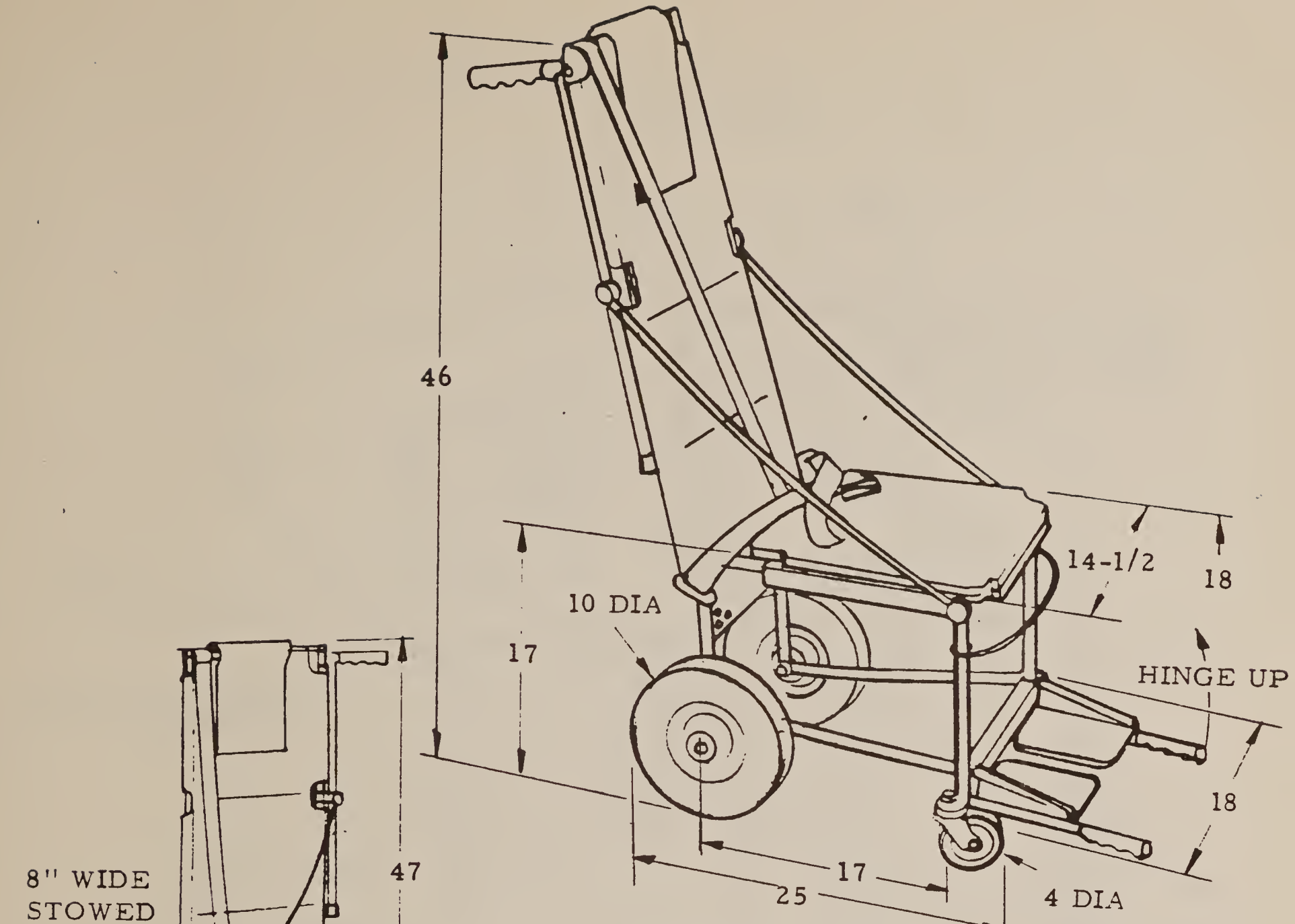
* including shroud support structure and attachments of 10 lbs.

TABLE G-1 AIRBORNE WHEELCHAIR COMPARISON



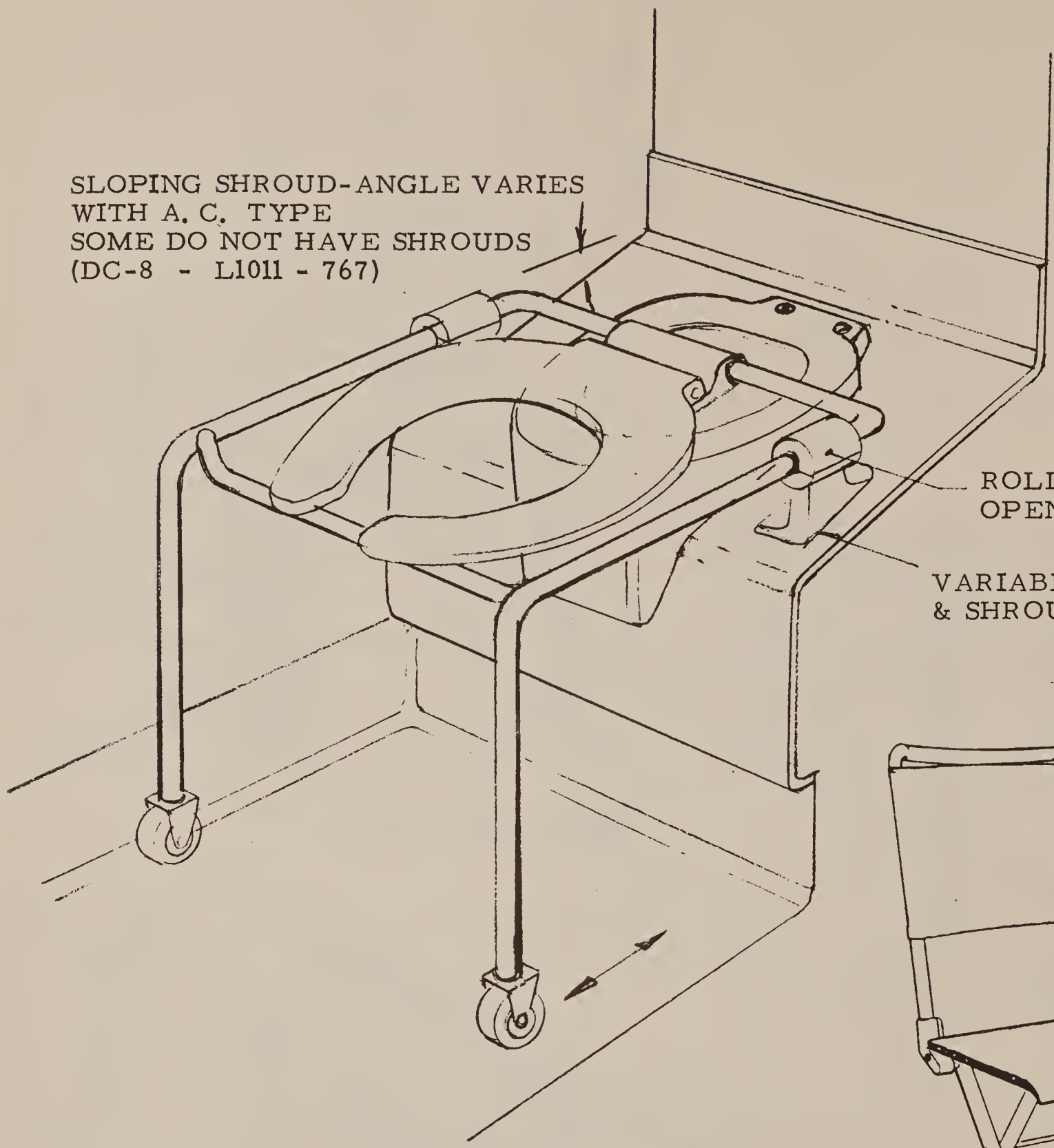
CARRIER AIRCRAFT
AIRBORNE WHEELCHAIR

FIGURE G-2



FULTON AIRPORT CHAIR

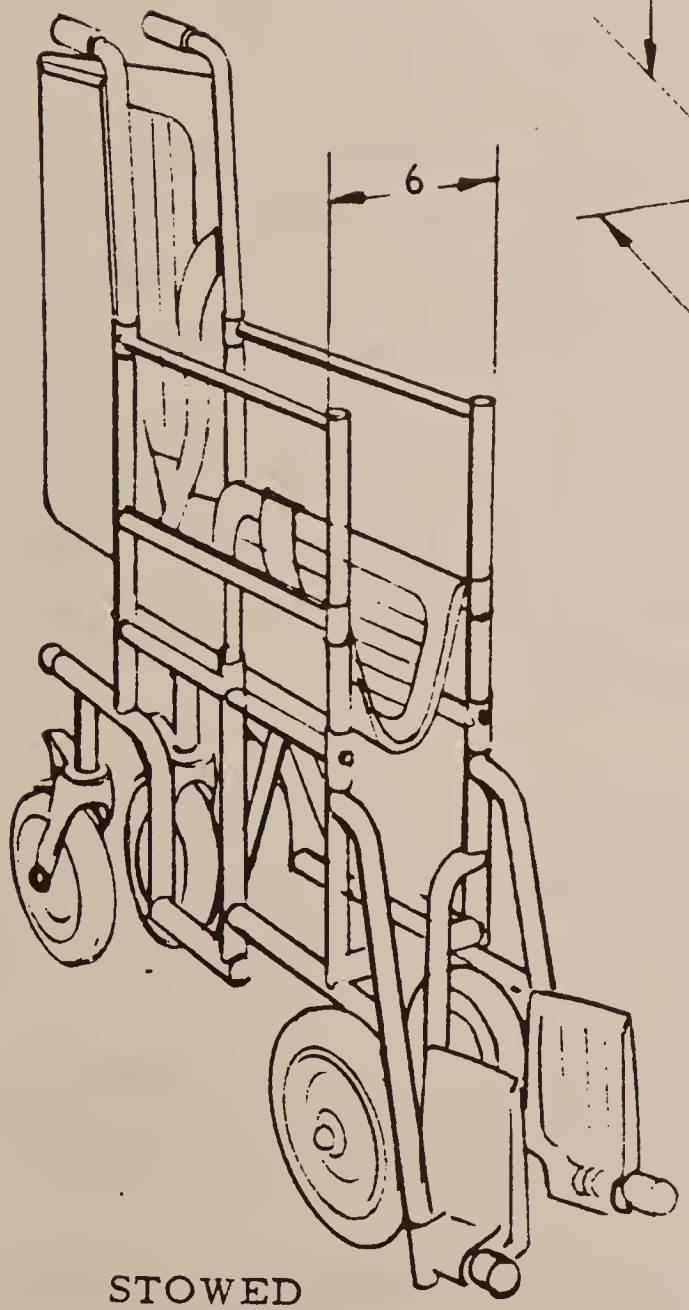
FIGURE G-3



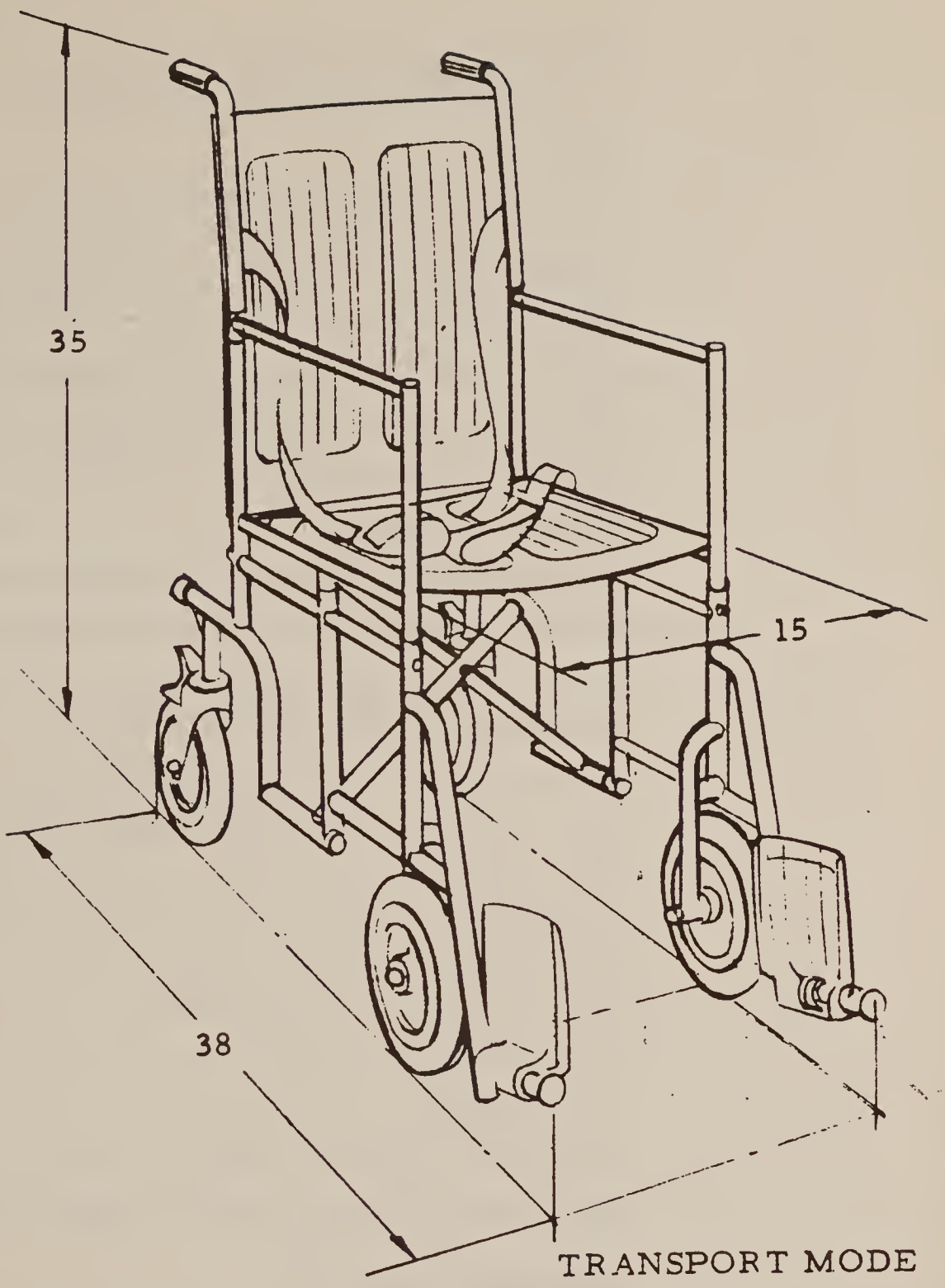
WHEELCHAIR

UNIVERSITY OF VIRGINIA
WHEELCHAIR SYSTEM

FIGURE G-4



STOWED



TRANSPORT MODE

EVEREST & JENNINGS
AIRCRAFT-PASSENGER
LOADING CHAIR

FIGURE G-5

APPENDIX H

H. STOWAGE OF AIRBORNE EQUIPMENT

H. 1 General

Wide-body aircraft interiors vary by customer, hence location of equipment will differ. Stowage is also a problem. Therefore, introduction of each piece of equipment was considered by TARC Project Group 218-2 before suggesting stowage aboard the aircraft. Where possible, loose pieces should be combined into a single unit such as an airborne wheelchair or packaged as in an aid kit for the disabled to minimize handling. Also, weight is always a concern. Future refinement of design could reduce equipment weights listed in charts and tables throughout this report.

H. 2 Kit for the Disabled Traveler

The kit size is approximately 4 x 10 x 12 inches. Weight is approximately 5 pounds. Some of the items within the kit may be handouts, hence, the need to replenish the stock. Specific location is not critical with respect to the use point, which may be anywhere in the passenger cabin. Due to the light weight and size of the kit, there are numerous locations for stowage such as coat closets, overhead racks, carry-on luggage areas, doghouse and bustle areas; subject to the individual operator's cabin equipment layouts and FAA approval.

H. 3 Airborne Wheelchair

The approximate size of the wheelchair, folded for stowage, determines the stowage requirements. The most compact and complete concept tested (Carrier Aircraft) folded to 10 x 17 x 21 inches with a maximum weight of 45 pounds.

When stowed, this item must be secured to prevent movement consistent with the requirements for any loose item in the cabin which may become a hazard.

Permanent stowage provisions may be made behind a last seat row, in carry-on luggage space, a coat closet, doghouse stowage unit or other utility space, designated in the operator's cabin layout, subject to FAA approval.

APPENDIX H

H. 4 Adaptive Equipment for Lavatory/Wheelchair Interface

Loose items, such as threshold ramps, should be stowed as close to the designated lavatory as practical. These items should be relatively small and light and should fit into the stowage space of a typical lavatory bustle or similar area. Class divider units with small bins, as well as coat closets, may be considered. Light weight items may be stowed in overhead bins near the designated lavatory.

The method of securing these items as a permanent part of the cabin equipment will be determined by the specific location chosen for stowage, based on operator preference.

APPENDIX J

J. SUMMARY OF TESTING FOR ACCESS OF DISABLED PERSONS TO WIDE-BODY AIRPLANES

J.1 General

The testing protocol was designed to assess the effectiveness of selected provisions proposed for existing wide-body aircraft by the TARC Project Group 218-2. The test protocol and methodology were developed by the staff at Daniel Freeman Hospital Medical Center in cooperation with TARC 218-2. Areas assessed included:

1. The use of the Carrier Aircraft Airborne Wheelchair in aircraft aisles and lavatories.
2. The use of the University of Virginia Wheelchair System in aircraft aisles and lavatories.
3. The use of meal service aids.
4. The use of the aircraft lavatory with assistive devices.

The analysis is an effort to assure that the proposed aircraft provisioning solves a majority of handicapped traveler problems relating to lavatory and seating access as well as meal service.

The University of Virginia Wheelchair System was analyzed by TARC 218-2 and Daniel Freeman Hospital Medical Center and improvements suggested. The modified system is undergoing tests at this time.

J.2 Equipment Testing Conducted at Daniel Freeman

J.2.1 Methodology

Subjects - A target population of non-ambulatory individuals was selected for the testing. In order to have a sample of individuals with a range of physical disabilities, requests to participate in the study were sent to 300 members of a local Center for Independent Living. The sample was made up of seventeen persons who responded to the request and who could be scheduled within the 10-day period available for testing.

APPENDIX J

The sample included individuals in all functional levels:

1. Dependent: those who require physical assistance of one trained personal attendant in mobility and activities of daily living and/or in the use of cardiopulmonary life support systems (respirator, O_2). The personal attendant was required to participate in the test procedure.
2. Semi-Independent: those who require occasional assistance of one person by following instructions as given by the handicapped individual. These individuals are independent in toileting and dressing.
3. Independent: those who require no assistance in mobility and activities of daily living.

J.2.2 Equipment

The testing was performed in five simulated lavatories which duplicated those in use on Boeing B747 and B767, Lockheed L-1011, McDonnell Douglas DC-10 and Airbus Industries A300, including basic features used by the passenger. In addition, aircraft seats were positioned to simulate an aisle width of 15 inches and a pitch between seats of 31 inches.

A prototype which included the basic features of the Airborne Wheelchair was used for the testing. A set of assistive devices which were selected or designed to solve problems associated with functional use of the lavatories as well as meal service aids were available for analysis. Similar testing, on a reduced scale, was accomplished at the University of Virginia using a prototype Wheelchair System.

J.2.3 Procedure

The seventeen subjects provided basic biodata, Form J-1, for

the study. The Airborne Wheelchair check-out, Form J-2, was used to collect data on the function of the chair in transporting the disabled individual safely and effectively. Transfer check-out, Form J-3, indentifies those transfers required in an aircraft and the ability of the individual to perform the activities using the Airborne Wheelchair. Lavatory check-out, Form J-4, was used to record each subject's ability to perform functional tasks in each simulated lavatory. General Information and Comments, Form J-5, enabled each subject to comment on additional aspects of air travel.

J. 2. 4 Results

The purpose of the testing procedures was to determine if the equipment proposed by the TARC Project Group 218-2 solved the major accessibility problems of current wide-body aircraft.

The test sample was small, however, the range of disabilities was diverse - and the three functional levels were included. At this time statistical data is available, but limited, due to the small number of subjects. There are general trends and findings which indicate the effectiveness of the Airborne Wheelchair and selected devices in the Kit for the Disabled and the appropriateness of further refinement. The findings are presented in three categories, the use of the Airborne Wheelchair, the use of the lavatory, the use of the devices in the Kit for the disabled.

J. 2. 4. 1 Use of the Airborne Wheelchair

1. The dimensions of the chair accommodated the subjects. No pressure points were identified except as noted in J. 2. 4. 1. 11.
2. Two people are suggested to guide the chair when transporting a passenger. One to push and one to guide. The chair is easy to push and pull.
3. The chair tends to tip forward if thresholds are crossed too abruptly. Seat belt and shoulder harness is recommended for passenger safety. (Production chair - shoulder harness added, seat belt not required).

4. The chair has to be lifted slightly to cross existing lavatory thresholds.
5. The chair entered all tested lavatories. Subjects needed to be cautioned about making contact with walls or doorways on some lavatories when entering and exiting.
6. The chair translated over all tested toilets.
7. Subjects with good functional use of arms and hands were able to position seat guide and seat on and off the toilet. The other subjects were assisted with minimal effort.
8. The chair guide required adjustment to accommodate height differences for each tested toilet.
9. The chair moved laterally while translated over toilet when passenger was disrobing and robing. A mechanism to give lateral stability is recommended. (Production chair - a roller assembly has been added to provide lateral stability).
10. Subjects who could stand for short periods of time needed the foot tray to be slid forward when chair was translated over toilet. (Production chair - tray will lift to vertical position).
11. Subjects were cautioned about possible pressure points on the lateral surface of their legs from exposed tracks when chair is translated over toilet. (Production chair - shroud added to cover exposed tracks).
12. Subjects were able to transfer to and from the chair and their personal wheelchair with no additional assistance.
13. A height difference between the chair and passenger seat resulted in two subjects requiring some additional moderate assistance in transferring from the passenger seat to the chair. Both of these subjects would have been able to transfer independently if the aisle arm rest could have been removed.
14. When the aisle arm rest was lifted, the subjects were able to transfer to and from the chair and the passenger seat with much less effort and required less attendant supervision and assistance.

J. 2. 4. 2 Use of the Lavatory

1. Slab doors on each lavatory tested can be closed when the passenger has translated over the toilet. Bifold doors opening inward cannot be closed.
2. Those passengers who are independent can disrobe and robe when using the chair in the lavatory.
3. Those persons who are semi-independent or dependent will require dressing assistance of a personal attendant.
4. Curtain close-offs around lavatories will aid those handicapped persons who need the assistance of a personal attendant for disrobing and robing.
5. Further research is indicated on specific clothing which will enable greater independence in dressing from the Airborne Wheelchair.
6. Rub strips added the partition opposite the lavatory to protect against damage.
7. A longer horizontal hand rail added to wall beside commode to assist passengers in dressing, in designated lavatory only.
8. Ramp placed over lavatory threshold to aid Airborne Wheelchair casters to enter lavatory.
9. Removable lightweight ramp placed in front of lavatory where floor of lavatory is higher than aisle.
10. Deletion of threshold strip to smooth the access to lavatory.

J. 2. 4. 3 Use of Aid Kit for the Disabled

1. The lavatory assistive aids permitted all independent and semi-independent subjects to use the faucet, the attendant call button, toilet paper, and the flush button independently. The majority of persons could also reach the paper towel, cup and soap dispensers.
2. Dependent subjects required assistance in the above mentioned tasks and would rely on the personal attendant.
3. The dining aids proposed for the kit solve problems for individuals who have hand dysfunction and may or may not be ambulatory.

APPENDIX J

J. 2. 4. 4 Summary

The Airborne Wheelchair, the Aid Kit for the Disabled and the movable arm rest on the aisle seat were evaluated as modifications to make existing wide-body aircraft accessible to disabled persons. The sample included 17 persons with diagnoses including paraplegia, quadriplegia, post polio, cerebral palsy, hemiplegia and neuro-spinal muscular atrophy. The findings indicate that the proposed equipment solve access problems to the aircraft seats and lavatories and enable independence in performing functional tasks. Refer to charts J-6 for test results.

To further improve testing and evaluation protocol, and to aid in the standardization of procedures, TARC Project Group 218-2, Carriage of Handicapped Persons, in cooperation with the Technical Advisory Committee on "Access to the Skies," of the National Institute of Handicapped Research" have agreed to use the Testing and Evaluation Protocol developed by Daniel Freeman Hospital Medical Center. The procedure has been expanded to include stairway boarding of aircraft in addition to the jetway approach.

Daniel Freeman Hospital Medical Center
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Director of Occupational Therapy

Louvenia Austin, OTR
Staff Occupational Therapist

Jeffrey Klein
Vice-President, Rehabilitation

APPENDIX J

J.3 Testing Conducted on Airplanes at Airport

The program is limited to wide-body aircraft. In order to satisfy standard-body aircraft, a limited study was made to determine wheelchair access. As a result, the Carrier Aircraft Airborne Wheelchair space envelope was sized to accommodate both standard and wide-body aircraft. Pan American Airways and United Air Lines provided aircraft for use in compiling the necessary data.

Pan American B747 and L-1011-500
United Air Lines DC-8, DC-10 & B727

In order to verify what had transpired at Daniel Freeman Hospital Medical Center during the test and evaluation program involving the lavatory mockups and wheelchair, a simulated commercial flight was rehearsed aboard a Pan Am 747 and video tapes made of the proceedings. All went according to plan in that verification was made of the following:

1. The Carrier Aircraft Airborne Wheelchair was accessible to at least one lavatory on all aircraft in which the chair was tried.
2. The aisle width of 15 inches minimum on standard-body aircraft was compatible with the 14-1/2 inch width of the Airborne Wheelchair.
3. It was possible to park the wheelchair in a doorway in flight without disturbing passengers. (A tether for securing the chair to aircraft structure is recommended for a rough air condition).
4. Sufficient mobility existed in the Airborne Wheelchair to navigate into and out of lavatories, cross aisles and confined areas of the aircraft.
5. The Aid Kit for the Disabled, with its dining and lavatory aids, would fulfill a need for the handicapped during flight.

APPENDIX J

J.4 Testing Conducted Aboard Pan American Flights

Once the proving phase of the program was completed and the capability of the equipment established, Pan American scheduled a cross-country flight, Los Angeles to Miami and return, to substantiate the use of the equipment, which up to that time had undergone only simulated flight conditions. A disabled individual who has paraplegia served as the subject. The same procedures were used to collect the flight data as were employed in tests conducted at Daniel Freeman Hospital Medical Center. The results mirrored those substantiated in Section J.2.4.1 and Chart J-6.

APPENDIX J

FORM J-1

DANIEL FREEMAN MEMORIAL HOSPITAL MEDICAL CENTER
CENTER FOR DIAGNOSTIC AND REHABILITATIVE MEDICINE

Aircraft Functional Analysis for the Disabled Traveler

BIO DATA

NAME:_____ PHONE #: (H)_____

ADDRESS_____ PHONE #: (W)_____

OCCUPATION_____

DIAGNOSES:_____

DISABILITY CATEGORY:

DEPENDENT (LIST ACTIVITIES):_____

_____

SEMI-INDEPENDENT (LIST ACTIVITIES):_____

_____

INDEPENDENT:_____

_____

BLADDER/BOWEL PROGRAM:

NORMAL BLADDER FREQUENCY_____ METHOD_____

NORMAL BOWEL FREQUENCY_____ METHOD_____

MODIFICATIONS FOR FLYING:_____

_____

_____

MODIFICATION SIDE EFFECTS:_____

_____

_____

HEIGHT_____ WEIGHT_____ FORWARD REACH_____

SIDE REACH_____ HIP WIDTH SITTING_____

Airborne Wheelchair Check-out

APPENDIX J

FORM J-2

DANIEL FREEMAN MEMORIAL HOSPITAL MEDICAL CENTER
CENTER FOR DIAGNOSTIC AND REHABILITATIVE MEDICINE

Aircraft Functional Analysis for Handicapped Traveler

	YES/NO	COMMENTS	PRESSURE POINTS (LOCATION)	COMMENTS
SEAT WIDTH 1" SIDE CLEARANCE FOR LEGS				
SEAT DEPTH 3" KNEE CLEARANCE				
FOOTREST ELEVATE THIGH 1" FROM SEAT				
ELEVATE HEEL 2" FROM FLOOR				
SECURES FOOT				
ABLE TO CONTROL				
ARM REST LEVERAGE SUPPORTS PASSENGER GUARD				
BACK HEIGHT APPROPRIATE FOR TRUNK SUPPORT RECLINES				
PASSENGER ABLE TO SHIFT WEIGHT				
TOLERANCE SITTING IN CHAIR (TIME)				
ABLE TO CONTROL SEAT GUIDE BACK FORWARD				
ABLE TO CONTROL SEAT TRANS-LATION BACK FORWARD				
RAMPS/THRESHOLDS				

DANIEL FREEMAN HOSPITAL MEDICAL

CENTER FOR DIAGNOSTICAL REHABILITATION MEDICINE

TRANSFER CHECK-OUT

TRANSFER	DIRECTION CHAIR TO SEAT	GAP BE-. TWEEN SEATS & L T (INCHES)	GREATEST HEIGHT DIFF. (INCHES)	ASSISTIVE DEVICES (LIST)	PASSENGER LEGS UP/DOWN	CHAIR/SEAT STABILITY GOOD/BAD	OBSTACLES TO PASSENGER (LIST)	ASSISTIVE PERSONNEL (WHO)	OBSTACLES TO PERSONNEL (LIST)	TRANSFER TIME (SECONDS)	COMMENTS
PRIVATE CHAIR TO AIRLINE CHAIR											
AIRLINE CHAIR TO PRIVATE CHAIR											
AIRLINE CHAIR TO AIRLINE SEAT											
LATERAL MOVE-MENT - AISLE SEAT TO WINDOW TO AISLE											
AIRLINE SEAT TO AIRLINE CHAIR											
AIRLINE CHAIR TO COMMODE											

APPENDIX J
FORM J-3

ARCHITECTURAL BARRIERS

B767
B747
DC 10
L-1011
A300

CHAIR STABILITY OVER COMMODE

B767
B747
DC-10
L-1011
A300

APPENDIX J

Lavatory Check-out

FORM J-4

DANIEL FREEMAN MEMORIAL HOSPITAL MEDICAL CENTER
CENTER FOR DIAGNOSTIC AND REHABILITATIVE MEDICINE

AIRCRAFT FUNCTIONAL ANALYSIS
FOR THE HANDICAPPED TRAVELER

TASK	ABLE	UNABLE	COMMENTS
1. Open door to lavatory			
2. Close door to lavatory			
3. Lock door to lavatory			
4. Remove lower extremity clothing			
5. Operate flush button			
6. Toilet paper dispenser			
7. Operate faucet position			
8. Use soap dispenser			
9. Use linen towel dispenser			
10. Use kleenex dispenser			
11. Use cup dispenser			
12. Attendant call button			
13. Operate sickness bag container			

Diagnosis of individual tested: _____

Functional level: Independent (I) Semi-independent (SI) __ Dependent(D)__

Evaluator's Initials _____ Date _____

APPENDIX J

FORM J-5

DANIEL FREEMAN MEMORIAL HOSPITAL MEDICAL CENTER
CENTER FOR DIAGNOSTIC AND REHABILITATIVE MEDICINE

Aircraft Functional Analysis for the Disabled Traveler

GENERAL INFORMATION AND COMMENTS

1. How frequently do you fly? _____
2. Which airline do you usually fly and on what kind of plane? _____

   _____
3. If you have never flown, has anything in particular discouraged you from flying? _____
4. Where on the plane do you prefer to sit? _____

   _____
5. Do you think you could deplane by yourself in an emergency? _____
6. Please describe any problems you have experienced in the following areas and any suggested changes to resolve these problems:

   6.1 Making reservations and arranging necessary assistance: _____

   _____

   _____

   _____

   _____

   _____

   6.2 Boarding and deboarding the plane: _____

   _____

   _____

   _____

   _____

   _____

   6.3 Receiving in-flight services such as help with meals, moving to the restrooms, retrieving canes or crutches: _____

   _____

   _____

   _____

   _____

   _____

   6.4 Retrieving baggage and personal equipment such as wheelchairs: _____

   _____

   _____

   _____

   _____
7. Additional comments about today's test or any other topic relating to air travel:

   _____

APPENDIX J

Lavatory Check-out

FORM J-6

DANIEL FREEMAN MEMORIAL HOSPITAL MEDICAL CENTER
CENTER FOR DIAGNOSTIC AND REHABILITATIVE MEDICINE

SUMMARY - AIRCRAFT FUNCTIONAL ANALYSIS FOR THE HANDICAPPED TRAVELER

TASK	ABLE			UNABLE			NOT APPLICABLE			DID NOT ANSWER		
	I	SI	D	I	SI	D	I	SI	D	I	SI	D
1. Open door to lavatory	8	4	-	-	-	1	-	-	-	3	1	-
2. Close door to lavatory	1	3	-	5	2	1	3	-	-	1	1	-
3. Lock door to lavatory	9	2	-	2	1	1	-	-	-	1	1	-
4. Remove lower extremity clothing	9	2	-	(1) 2	1	1	-	-	-	1	2	-
5. Operate flush button	11	3	-	(1) 1	1	(2) 1	-	-	-	1	-	-
6. Toilet paper dispenser	10	(3) 5	-	-	-	1	-	-	-	1	-	-
7. Operate faucet position	10	3	-	-	-	1	-	-	-	1	2	-
8. Use soap dispenser	10	3	-	-	1	1	-	-	-	1	1	-
9. Use linen towel dispenser	9	3	-	1	-	1	-	-	-	1	2	-
10. Use kleenex dispenser	9	4	-	1	-	1	-	-	-	1	1	-
11. Use cup dispenser	9	2	-	1	1	1	-	-	-	1	2	-
12. Attendant call button	10	4	1	-	-	-	-	-	-	1	1	-
13. Operate sickness bag container	9	3	-	-	-	1	-	-	-	2	2	-

Form J-6 includes the evaluations of 17 people
(Data from Forms J-1 & J-2)

Functional level: Independent (I) Semi-independent (SI) Dependent (D)

1 Person marked able for all models except the B767, which explains extra count

2 Person was able to operate B747 flush button

3 Person marked able is unable if the button is behind him

APPENDIX J

FORM J-7

NO.	PHYSICAL CONDITION OF INDIVIDUALS ENTERED IN SUMMARY - FIGURE J-6	BIO DATA	Functional Analyses	Used for Combined DATA
1	Multiple Sclerosis	-	I	I
2	Polio Paraplegia	I	-	I
3	Quadraplegia C5-6	D	D	D
4	Post-Polio	I	SI	SI
5	Cerebral Palsy	I	SI	SI
6	Paraplegic spinal cord injury T_{10-12} GSW	I	I	I
7	Paraplegia T_{4-5}	I	—	I
8	Quadraplegia with some U. E. (upper extremity) function	SI	-	SI
9	Post Polio Quadraplegia trunk is good, use of right side, min. of left	I	-	I
10	Spinal cord injury $T_{1,2}$	SI	I	I
11	Polio, GSW mid/low thoralic (thorax)	I	I	I
12	GSW right upper thoralic (thorax)	I	I	I
13	Paraplegia	I	I	I
14	CVA right Hemiparalysis, no use of right hand	SI	SI	SI
15	CVA left Paraplegia	SI	—	SI
16	Spinal Injury T_{4-5}	D	I	I
17	Neuro Spinal Muscular Atrophy	SI	I	I

Independent - (I)

Semi-independent - (SI)

Dependent - (D)

CVA - Cerebral Vascular Accident

APPENDIX J

FORM J-8

TESTEE'S COMMENTS

INDIVIDUAL	COMMENT	HANDICAP
17	1. Lock door to lavatory-possible with reacher 2. Operate flush button-with proximal hand 3. Attendant call button-possible with reacher	Neuro Spinal Muscular Atrophy
15	4. Operate flush button-problem with trunk rotation	CVA left Paraplegia
14	5. Close door to lavatory-unable sitting/able standing 6. Operate flush button-unable unless stand and turn	CVA right Hemiparalysis No use of right hand
4	7. Lock door to lavatory-unable trunk balance	Post-Polio

* Refer to Form J-7 for physical condition of individual.

APPENDIX K

K. SUPPLIER INFORMATION

	SUPPLIER/ADDRESS/PHONE
WHEELCHAIRS	
Airborne Wheelchair	Joseph De Rosa Director - Marketing & Product Development c/o Carrier Aircraft 2750 E. Wardlow Rd. Long Beach, Calif. 90807 (203) 595-5306
Airport Chair	Robert Fulton Company Flying Ridge Newtown, Conn. 06470 (203) 426-9700
Wheelchair System	Colin A. McLaurin Engineering Director University of Virginia 1224 W. Main Street Charlottesville, Va. 22903 (804) 977-6730
Aircraft Passenger Loading Chair	Klaus Schacher Marketing Manager Everest & Jennings Canadian Limited 111 Snidercroft Road Concord, Ontario (416) 669-2381

APPENDIX K

K. SUPPLIER INFORMATION (Continued)

	SUPPLIER/ADDRESS/PHONE
AID KIT	
Aid Kit for the Disabled	Jeffrey Klein Vice-Pres./Rehabilitation Services Daniel Freeman Hospital Medical Center 333 No. Prairie Ave. Inglewood, Calif. 90301 (213) 674-7050 Ext. 3470
PASSENGER SEATS	
	Gerald H. Langendoerfer Division General Sales Mgr. UOP Inc. Bantam, Conn. 06750 (203) 567-9441
	Ralph G. Marrujo Director - Planning & Research Fairchild Burns Co. Division 1455 Fairchild Drive Winston - Salem North Carolina 27105 (919) 767-6010
	Robert Oppegard Senior Sales Engineer Weber Aircraft 2820 Ontario Street Burbank, California 93010 (213) 848-5543 Ext. 518

HV1708
Ae82 Carriage of handicapped persons.

DATE DUE

AMERICAN FOUNDATION FOR THE BLIND
15 WEST 16th STREET
NEW YORK, N.Y. 10011

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